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1991 Annual Index

LETTERS

From the Hamshack

Ronald Schmidt WA5QBA, Garland TX Back in 1973, I paid $73 for a lifetime subscription to *73 Magazine*. That was one of the best investments I have ever made. 'Nuff said.

Max Holland W4MEA, Hixson TN I really like hamfests. The first one I attended took place in 1955 in Dayton, Ohio, in the halls and lobby of the Biltmore Hotel. Leo Meyerson of World Radio Laboratory played the electric organ for entertainment.

I attend approximately 10 hamfests per year. Sometimes I have found some real bargains. Most of the bargains are products manufactured by the AS IS Company. As an example: At the Dayton Hamfest I brought a receiver that was clearly marked AS IS. I only paid $2.00 for it. It didn't work, and some of the components looked burned, but it was a real bargain. At another hamfest I bought an AS IS printer for $5.00. When I got home, it didn't work either. I believe I could fix most of these things if I had the technical manuals. Does anyone know the address of the AS IS Company?

Kent C. Babcock, Arcadia MI I'm still a no-call, as I'm waiting for the study materials I ordered from *73*. In the meantime, I'm listening to hams on a couple of communications receivers, and I must admit to being somewhat surprised at what I'm hearing, mostly on 14.313 MHz. I hope I can be assured that the vast majority of hams are as offended by this juvenile foolishness as I am.

This brings me to my point. As a CBer, I have never heard anything worse on 27 MHz than some of the crap I've heard from supposedly legitimate amateur radio operators. Wayne, keep that rolled-up newspaper handy and continue to swat those holier-than-thou hams who insist on calling CBers names over the back fence.

You also have my promise that when I do get my license I will do my best to uphold the standards of good amateur conduct on my part *first* and then worry about the practices of others.

Thomas E. Durfee, Jr., WI8W, Big Rapids MI I really enjoy reading *73*, and I find that Wayne Green hits it right on the head when it comes to telling it like it is. He keeps telling me to get off my duff and write something, and by God that's just what I'm gonna do. Keep up the good work.

Charlie N4TDY, Raleigh NC I decided to take some of your advice and do something new and different for a change over the past year. I have been reading *73* for about four years, and I've only been a ham for three years and four months.

My first license was the Tech, and it took me about a year and a couple of months to upgrade to Extra. Hey, would you believe I am yet to make a code contact. Bet you the old-timers hated to hear that statement.

Wayne, this is the first time I've written any known public media. I am now also taking a Spanish class, and I joined OMIK this year and went to its convention in Charleston, South Carolina. I have participated in a number of Boy Scout activities with my son, which I never took the time to do before. I have gone out and bought fishing gear, which is something I always wanted to do, and would you believe that I am writing this letter with a new computer. Three weeks ago, Wayne, I did not know what DOS was; look at me now, a 386 with the works!

Dennis D. Spreng KB0IRY, Lake Crystal MN I wrote to you several months ago about how I was dissatisfied with my job at the post office, and how your editorials had convinced me to change. For starters, I enrolled in an electronic communications course, passed my Novice exam, and started my own communications business. I am still working at the post office for now while I get things rolling.

This has not been easy for me to do. I am typing this at 3:00 a.m. after working eight hours at the post office. I have spent money to get started, but I believe it is worth it. You are exactly right about how making money means changing, and we are all basically lazy and begrudge those who do work hard. People at work give me a hard time about this, but that is their problem.

My business is just getting started. I am planning a direct mail program for later this month. I am a dealer for several antenna and radio lines. I also carry emergency vehicle products. I am even considering advertising in *73*! I am working hard at this career change, and your editorials are what got me started. I hope in a few years you can put my success story in your column.

Jerry Wetzel W3DMB, Butler PA I have read your editorials since the early 1950s, so I have a general idea of your opinions as they have evolved over the years. Do you "worry" if anyone doesn't agree with what you write? (Fat chance!) Recently, the following editorial policy appeared in the local club newsletter.

"It is very difficult for an editor to print any news if he is afraid of having someone disagree with his editorials. Therefore, in the future, any BCARA member who disagrees or is upset by anything that is in the Tell-A-Ham can bring his/her copy to the next regular meeting. The editor will have a pair of scissors and will cut out the offensive article from that person's copy of the Tell-A-Ham."

At *73*, would you rather people who disagree cancel subscriptions, write a letter, or just steam (assuming they won't change their mind)?

. . . write, giving some rational reasons for disagreeing. I do my homework before writing, so why shouldn't people who disagree do theirs, too? I'm always open to new data and able to change my opinions if the data dictates. Wayne

Clark J. Evans WA4DLL, Tampa FL *WA4DLL asks us to print the following:* Clark J. Evans, Sr., used amateur radio operators around the world to trace where the width (4'8½") of the United States train tracks came from. Clark got interested in track gauge through his father, John T. Evans, Sr., who worked for the Pennsylvania railroad for 47 years. It took over six years of research to trace where standard gauge (4'8½") came from.

The United States got the gauge from England because they built the first steam engine. England got it from the Roman chariot. The Romans got it from the Celts. The Celts got it from common horse sense. It is the width of two horse rumps standing side by side pulling a cart, wagon, or chariot. You always made the wagon, cart, or chariot a little smaller so it wouldn't get stuck in a narrow opening.

Thanks to IK8HEP (Italy), IK8DXX (Italy), IK8BQE (Italy), IK8BLM (Italy), and GW0MAW (Wales). Thanks also to Joan and Betty Ruck of Altoona, Pennsylvania.

InSuk J. Granholm KA7TAG, Monett MO You write wonderful and enthusiastic editorials! I especially enjoyed your information on Amelia Earhart. Although I have had my Novice license since 1984, I have made just one contact. I got the license because I happened to learn the code with my husband who was studying for his Novice license. Not being technically minded, much of the ham magazines do not make sense to me.

Since I started reading my husband's *73 Magazine*, your editorials have me fired up, and I intend to study and upgrade and become active. Like you, I have numerous projects going on. I have started writing and hope to be published again. I have also begun a book about my adoption and life in Korea and in America. Thank you for sharing your enthusiasm. May you live another 30 years to continue sharing it.

Stephen D. Goff N8IVX, Bellevue OH This is in reference to a letter in the November 1991 issue by Mr. Bovee about repeater coordination. First and foremost, the FCC DOES NOT assign repeater frequencies. They also DO NOT initiate nor approve band plans. They authorize amateur frequencies in blocks, and it is the responsibility of amateurs to govern themselves in this regard. In Ohio, the recognized frequency coordination organization follows the ARRL approved band plan. Not all states follow this same band plan, and unfortunately for Mr. Bovee's group, neighbors of Ohio do not follow the same band plan, which renders useless many pairs that would be otherwise available. Different geographical areas require (or desire) different uses of the available spectrum. The situation that Mr. Bovee's group has encountered is purely geographic. The thought of one pair per band per individual/club has merit, with one exception: as more special interest groups are formed and want their "own" pair, will the idea of one pair per band PER CITY/AREA crop up? The question will ultimately arise as to why one city or area needs duplicate coverage on one band. Who gets to stay, and who goes? Should we ask the FCC to sell spectrum to us so only the groups with lots of members can have repeaters?

Why DO we need so many repeaters? Is it because we can only associate ourselves with others who agree with only us, who think like we do? I believe it's time for amateurs to work together, to coexist, and to show the "newcomers" that we really are a fraternity dedicated to the continuation and extension of our unique ability to enhance goodwill, locally AND internationally. When that day comes, we will no longer have need of all the repeaters that are in existence today.

James Dillon N0KWA, Rapid City SD Could you please announce in *73* that I am trying to start a net related to astronomy where fellow hams could discuss the technical and observational aspects of astronomy? I think that such a net could help make for some interesting QSOs and teach amateur astronomers about ham radio. My packet address is N0KWA @ W0BLK.SD. My home address is 801 East Ohio Street, Rapid City SD 57701.

Larry Junstrom KN4UB, Jacksonville FL I have started a Celebrity and Entertainers Net, and the response has been quite good, but I feel it needs additional publicity. I am wondering if you could put a plug in for the net. There are quite a few hams in the entertainment business, and I would like to get them together.

The net meets on Mondays and Thursdays at 2300Z on 14.265 MHz, ±QRM. I travel quite a bit with my band, but there are other guys who will act as net control in my absence. The net is run in a civilized and gentlemanly manner so as not to invade the privacy of any truly famous personalities.

Gary N. Babcock WA5BMN In response to the letter submitted by AA9AN in the October issue of *73*, regarding contesting on the amateur radio frequencies, I find his point of view very parallel to mine. This contesting has gone to the point of making the amateur bands useless during many of these marathon QRM sessions. I have often wondered what the outcome would be if another San Francisco earthquake were to occur at the exact moment that the famous SWEEPSTAKES contest begins. I can assure you it would not be for the benefit of mankind, judging by what I have heard during contesting operation over the 30-plus years that I have been in this hobby.

In regards to the editorial response given to AA9AN not to complain to the FCC, I can assure you that contacting the contest organizers will get you nowhere fast. I have contacted many of these organizers over the years to suggest a sensible method of contesting that the general amateur population could live with, and I have been told everything from "Mind your own business" to "Don't complain to us, we aren't the problem." If the organizers are not the problem, it seems to me that some sort of FCC regulation may be necessary to correct the problem of totally obscuring the amateur frequencies with this senseless QRM. It seems that the amateur community is unable to regulate itself in this area. Perhaps the involvement of the FCC is the answer many of us are looking for. I welcome any comments from other amateurs who would like to use their radio equipment on the weekends again.

73 Amateur Radio Today

JANUARY 1992
Issue #376

TABLE OF CONTENTS

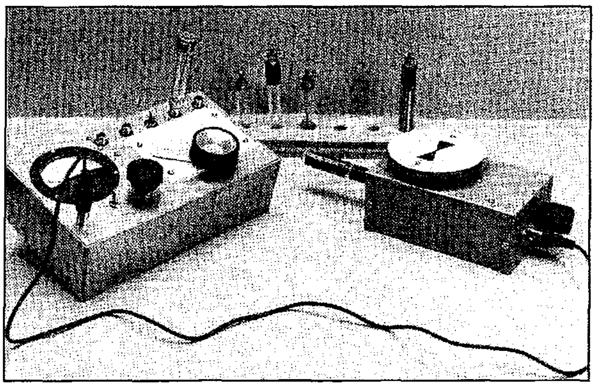
FEATURES

REVIEWS

BOOK REVIEW

Cover: Associate Publisher David Cassidy N1GPH destroys another perfectly good circuit board.
Cover design: David Cassidy, Larry Dunn
Cover photo: Larry Dunn

DEPARTMENTS



Build a field-strength/dip meter...see page 8.

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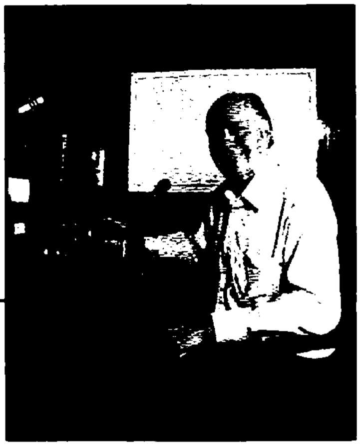
Audit Bureau of Circulations (ABC) membership applied for.

Contract: It's New Year's Resolution time, and just by reading this sentence you have become legally obligated to the staff of *73 Amateur Radio Today* to resolve to pick at least one project in this issue and build it. You'll have fun, acquire a deep sense of accomplishment and pride, and you might even learn something.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Repeater Guides

Unless you've got moss growing on your back, you at least occasionally get away from your home town—in which case you'll want to know what repeaters are where. Well, having a list with you beats the hell out of kerchunking all possible frequency pairs to see what's around—particularly if you're driving from one repeater area to another. And let's see, are they using 15 or 20 kHz spacing between channels around here?

When I was busy in the 1970s trying to get repeaters going, I used to publish a $5 *World Repeater Atlas*. It sold well and did the job. It had a list of every known repeater with its in/outputs, plus state maps showing the transmitter locations. We also had a cross-index by frequency. By 1980 the *Atlas* ran to 274 pages.

Then the League started handing out repeater lists for free at hamfests. They weren't nearly as complete, but they almost stopped my *Atlas* sales, forcing it to be discontinued—whereupon the League started charging for theirs. It's $6 today, has only the repeater listings and no maps, and doesn't cover hundreds of repeaters in Europe, Africa, Asia and Oceana. Their list is handy if you know where all the little towns are—which you probably don't—and don't travel abroad.

This need for maps got Bill Smith N6MQS busy with his Macintosh. He's publishing a *U.S. Repeater Mapbook* (see the "New Products" section in this issue of *73*) which sells for $10. It's got the 50 state maps (plus Canada) with the repeater output frequencies shown. The larger cities have separate boxed listings. It's a good book to keep in your glove compartment, or to pack when you're flying somewhere.

I've got the cutest little quarter-wave telescoping magnetic mount antenna that I use on rental cars. Picked it up at Dayton from the folks at Cellular Security Group. It sure beats trying to use an HT in the car.

The frustrating part for travelers is the lack of response when we call in on repeaters as visitors. I joke that we appear to have finally accomplished the ultimate—one repeater for each 2m ham. The sad fact is that in many cities I'm able to raise several repeaters, but seldom able to get any answer when I ask if anyone is there. And no, it isn't that they don't want to talk with me in particular. I'd say that maybe 10% of the hams I contact ever connect my call and name with me.

As I've mentioned in the past, I find it irritating to call and get no answer, then, seconds later I hear someone call a friend to see if he's listening, just to let me know that visitors aren't welcome on this repeater. If you aren't a paid-up member, keep the hell off our channel. I guess that's the "good new" ham spirit—as differentiated from the "good old" ham spirit. Alas, I'm still stuck in the past when amateur radio used to be like a fraternity and friendliness was the rule, not the rare exception.

Speaking of friendliness, I was amused to see that one of the Los Angeles repeaters finally made the newspaper headlines for being so outstandingly awful. I'll bet I could do a good business selling tapes of our cesspool to CBers to show them how good the CB channels are compared to amateur radio these days. I've got some interesting CB tapes, but nothing approaching what we hams have been able to produce. Right now L.A. is even beating out New York for repeater obscenity, but it's by a nose.

But what about the FCC, you ask? Oh, come *on*. They've several problems—like we're supposed to be self-regulating—like the FCC is under enormous pressure from industry and lobbyists to take away our frequencies and put them to better use—like the FCC's shortage of funds for trying to cope with our seemingly unlimited supply of wackos (all excellent CW ops, by the way). The FCC seems to feel that it's our responsibility to police our bands, not theirs, so where's our national organization which should be dealing with this mess? And why do the League directors remind me so much of Congress? Well, I don't blame them for ignoring our messes. I blame you for not cleaning house at election time. We also need to do some house cleaning in Washington. . .and senate cleaning too. But for some reason you blindly re-elect the same do-nothing turkeys every two years.

There I go bad-word processing the League again? No, I'm putting *you* down for not cleaning up the ARRL at election time. The League is fine in what it does. It's got some fine awards—like the DX Honor Roll, which has forced most amateurs from rare countries off the air. And there's its fantastic traffic handling system which shuttles thousands of completely useless CW messages around the country, losing a few in the process and delivering the rest late. I say give credit where credit is due.

And what other national organization do we have to represent us at ITU conferences? Of course they haven't bothered to do their homework, but then it's a non-profit organization, so we can't really expect it to be very effective, right?

The part I liked the most was when the League killed off 85% of our ham stores and 95% of our American ham manufacturers, thus opening our market to Asia. It was hilarious as Hallicrafters, Hammarlund, National, Millen, Johnson, Centra Electronics, Gonset, B&W, Multi-Elmac, Thordarson, UTC, Lakeshore, Webster, SBE, World Radio and others paid the League millions while it killed their companies.

Ah, but that was a long time ago, back in the 1960s with another bunch of directors, now dead, far's I know. But the loyal ARRL members, despite anything I and other ham journalists could write explaining what was happening, supported them to the hilt, re-electing them like clockwork. A recent *Westlink* editorial called these loyalists "League Lemmings." I kinda like that.

Time Multiplex

How many years have I been suggesting (pleading?) for some ham experimenters to tackle time multiplex technology? And how about my touting digital voice communications? Well, wouldn't you know that Motorola has put the two together, calling it Time Division Multiple Access (TDMA). This will make it possible to stack up to six conversations, all on the same channel.

Well, we can do that too! The next time you hear anyone whining about QRM, just keep in mind that the main reason we have QRM is because we're 30 years behind in technology, not because we have (a) too many hams or (b) too few frequencies.

As a matter of fact, if we can change to digital voice transmissions we'll be able to go full duplex, even when we're in contact with someone on exactly the same frequency. With digitized voice and a multiplex system, six hams will be able to talk with each other in full duplex, all on one channel.

Perhaps, if we're all too old and too tired to even try to develop the equipment, we'll be able to get the Japanese to do it for us. We're not talking about anything terribly complicated here. . . certainly nothing a clever 14-year-old ham couldn't whip together after school.

How much would such a technology be worth if someone bothered to develop it? Something like that is all it would take for an entrepreneur to build a pretty big business. Motorola says they'll have it available commercially in another year, so in a few years we'll be able to put a dollar figure on the development. If it's worth less than a few tens of millions, I'll be surprised.

Liars Figuring Again

The Gettysburg licensing figures can be interpreted to show a huge growth in new licenses as a result of no-code. Alas, I suggest you view those who do this as charlatans. . .or dummies.

The no-code ticket has boosted new Tech licenses to a fairly steady average of 2,800 a month vs. a tenth that in previous years. Wow! A ten-times growth! Awesome. We're packing 'em in.

Well, sure, but when we look at what's happened to the Novice new licensees we see they've dropped an average of 500 a month. That drops our overall gains a tad.

The bottom line is that according to the FCC's figures we've gained about 7.7% in total licensees since this time last year. The eentsy problem with this is that for the last three years the FCC has stopped deleting deceaseds and non-renewals. This has given us a great-looking boost in our numbers. . . kinda like a Chicago election, with voting gravestones.

Thus, the apparent 7.7% growth is obviously somewhat inflated. Looking at the FCC's figures for earlier years suggests this is adding about 5% of statistical bloat. The apparent growth for the last two years was 6.1%, so we've at least progressed 1.6% due to no-coders.

I know the League Lemming hordes won't forgive me for "Trashing the League" by bringing this up, but our real growth from 1946–1963 was an amazingly steady 11% per year. That was before the ARRL's Incentive Licensing debacle almost killed the hobby. . .and did virtually kill the ham industry.

The no-code license has increased our growth. . .about doubled it from an actual 1.6% to 3.2%, and that's good stuff. But we're still creeping when we should be running. If your club hasn't set up classes for newcomers, if you don't have a team scouring the CB channels for youngsters, if you're not sending club members into

Continued on page 80

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Spectrum Use Today

Private Radio Bureau Chief Haller of the FCC spoke at the Spectrum Summit for Emerging Technologies in Washington last November. The *W5YI Report* printed excerpts transcribed from on-site recordings. Haller: "The demand for spectrum is unparalleled. Since 1968, there's been over a 400% increase in the number of licensed land mobile transmitters in this country. That is a 10% annual growth rate. In the last six years alone, the total number of transmitters below 470 MHz has increased from 7.5 million to 11.5 million. And if that weren't enough, the traditional users of land mobile radio are anticipating even more advanced kinds of services. More remote control. More digital. More automation. All of these things place a heavy demand on the spectrum.

". . . I don't know how to provide those additional channels without some very difficult and perhaps expensive changes in the way that we do our processes at the Commission, and the types of systems we license. It's a tough balancing act, and one that's not going to get easier for the government generally or for the FCC in particular. The tight budget under which our agency is forced to operate this fiscal year, and next fiscal year, will require us to do more with less, notwithstanding the explosive use of spectrum today.

"As a federal regulator. . . I think of myself as sort of an acrobat on the high wire. On the one hand, I'm charged with trying to ensure as far as possible that new technologies can come on line and have a place, a home in the spectrum. Then on the other hand, with the number of transmitters I've told you about, there is a tremendous existing investment out there. So we have to be careful that changes we implement don't, overnight, wipe out that existing investment.

"It also means letting people try, so far as possible, to bring new applications into the marketplace. Section 7 of the Communications Act requires the Commission to encourage the provision of new technologies and services to the public. One of the problems is that we have no way of knowing what those technologies are going to be. So very often our rules are way behind the industry. A new idea is presented to us, and we have to go through a lengthy rulemaking process to get that technology on the air. By the time we've gone through the process, the poor entrepreneur is bankrupt and the technology goes away, and we never see it.

". . .the Commission recently adopted rules to release the 220-222 MHz band for narrowband technology. This provides for the first time a home for very spectrum-efficient narrowband voice and digital technology, using about one-fifth to one-sixth the spectrum of existing two-way services. At a time when spectrum availability is very scarce in the large metropolitan areas, we have great hopes that this new service at 220 MHz is going to provide an expansion area for systems."

Regarding Haller's speech at the ARRL National Convention in Saginaw, Michigan, reported in last month's "QRX," Haller said that he was not sure if he used the words "excess capacity," but he does not have a problem with that term. "Excess capacity means you can do something more, and still get your basic communications through. In my mind, excess capacity is not a spectrum term. It doesn't mean 'too much spectrum.' It means you have capacity enough to do the basic communications and something else." As to changing FCC Rule 97.113 on "Prohibited Transmissions": "I have serious concerns about opening up the Amateur Radio Service to such an extent that it becomes a substitute for other services. And yet, I think there are things that can be done beyond what the current rules permit that do not compromise the Amateur Radio Service." TNX *W5YI*. For more details, see Vol. 13, Issue #22 of the *W5YI Report*.

WARC-92

The FCC has released the U.S. proposals for WARC-92. Those with a possible impact on amateur radio are: *HF Broadcasting and 40M:* The FCC recommends that 1325 kHz of spectrum be reallocated from the Fixed and Mobile Service to broadcasting. The new bands would become available on June 30, 2007. By this same date, broadcasting would have to be fully converted to Reduced Carrier Single Sideband (RSSB).

In the 40m band, the Amateur Radio Service would be allocated 6.9 to 7.2 MHz worldwide. At 6.9–7.0 MHz, amateurs would share spectrum with Land Mobile, amateurs the primary users, and Land Mobile, secondary. At 7.0–7.2 MHz, amateurs would have exclusive access. Region 2 broadcasters would gain exclusive access to 7.2–7.3 MHz, worldwide. Other proposed, new HFBC allocations (worldwide, non-shared, all adjacent to existing allocations) are: 5.900–5.950, 7.300–7.525, 9.350–9.500, 11.550–11.650, 13.800–13.900, 15.600–15.700, 17.450–17.550, and 18.900–19.300 MHz.

Mobile Satellite Service: The U.S. proposes that the 137–138, 148.0–149.9, and 400.15–401.00 MHz bands be shared between low earth orbit satellite systems and other users. The LEOs and as many as three other services would all have primary status in these bands. A 150 kHz segment at each edge of the 137–138 MHz band is proposed for the Meteorological Satellite Service on a secondary basis. There had been concern among amateurs in Regions 2 and 3 that the LEO proposal for 148.0–149.9 MHz would drop below 148.0 MHz.

The FCC has withdrawn its preliminary proposal to allocate 420–421 MHz to LEO satellite systems on a secondary basis. This is welcome news to amateurs in Australia, Jamaica, the Philippines, and the U.S., who have secondary status at 420–430 MHz.

The FCC proposal would allocate 2390–2430 MHz to the Mobile Satellite Service (MSS) on a primary basis, for use as an uplink to MSS geostationary satellites. Amateurs would retain their current secondary allocation at 2300–2430 MHz in all three regions. (In Australia, Papua, and the U.S., 2310–2390 MHz is reserved for aeronautical telemetry.) The future of the amateur satellite program is limked to the continued availability of the segment 2400–2450 MHz.

Broadcasting Satellite Service: The FCC is not nearly as definitive in its proposal for allocation to digital audio broadcasting (DAB). Some spectrum would come from the 1429–1525 MHz segment. In the U.S., this would require moving aeronautical mobile test telemetry to other bands, possibly to 2310–2390 MHz. Further, the FCC proposal would allocate spectrum for DAB from the 2300–2390 MHz segment, most of which is currently dedicated to aeronautical telemetry. This proposal does not completely appeal to anyone, and further consultations are scheduled. TNX *Westlink Report, No. 613.*

SAREX STS-45 Hams

Ham astronauts Brian Duffy N5WQW, David C. Leestma N5WQC, and Dirk Frimout ON1AFD of Belgium are scheduled to fly on the STS-45 flight of the Atlantis this coming May 1992. Duffy will pilot the *Atlantis* on the seven-crew, eight-day mission. They will fly a high inclination orbit, much like those flown by Owen Garriott and Tony England (57 degrees, rather than the usual 28.5), therefore passing over most of the populated areas of the world, giving good coverage to hams on all continents. Altitude will be 160 miles. The astronaut hams will be restricted to battery powered FM voice operation on 2 meters.

As planned, this will be a CQ mission, meaning that there will be several attempts to work as many stations as possible. Some school contacts will be arranged, too. The SAREX Working Group plans to release the timetable and frequencies as soon as they are available. The mission's prime objective will be to use an Atmospheric Lab for Applications and Science that will be carried in an igloo in the payload bay. TNX *Westlink Report, No. 610,* and the *OSCAR Satellite Report, No. 232.*

The Dual-Combo Field-Strength and Source Dip Meter

Versatile test instruments for all your RF projects.

by Martin Beck WB0ESV

Most field-strength meters described in ham literature are coil-capacitor tanks with a diode and a meter. These FSMs are useful, but not sensitive enough for many jobs where the RF is not very strong. I frequently need something better, so I designed the device described here.

The most notable feature of this FSM is that instead of a DC amplifier, it uses an RF amplifier: a grounded-gate FET. After RF amplification, the signal is capacitively coupled to a diode voltage doubler whose output is fed to a 200 μA meter. For those who want the ultimate in sensitivity, a simple bipolar DC amplifier can follow the diode doubler.

More than 20 years ago I used such a system, but it was all bipolar. I took it to the annual Field Day operation of the W6LIE radio club. During a break in operation, I noted that my FSM's meter was reading up and down, but no local signal was being generated. I determined that the FSM was reading 15 meter *received* energy being re-radiated from a 15 meter yagi at about 40 or 50 feet up!

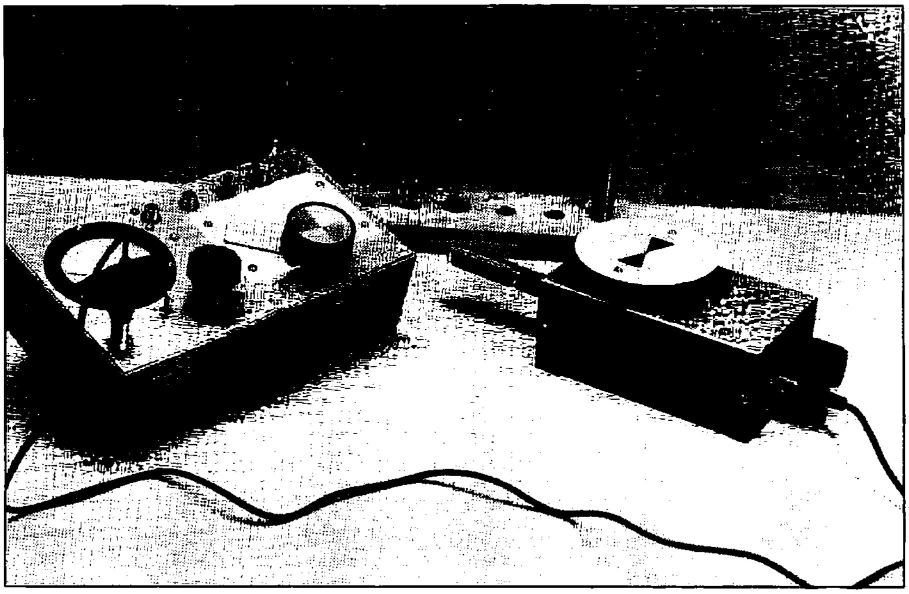


Photo A. The field-strength meter (left) and the source dip meter (right).

Construction Details

The device shown in Figure 1 uses three "tricks." First, the FSM uses the same plug-in coils as the source dipper described later in this article. Second, the dipper uses the FSM's meter. Third, switch S1 not only switches the meter from the FSM to the dipper, but also turns on the power for the FSM's FET when in the FSM meter position. The FSM uses two extra plug-in hairpin loop coils to extend its range a little bit.

Note that in Figure 1 the 365 pF air variable capacitor C1 is not shown. This was for the sake of clarity. C1 is on the opposite side of the board. Two bolts hold it to the board. Any broadcast capacitor will do (from a "junker" AM radio, for example)—just use one section. It does not have to be bolted to the board, but a short heavy lead should be run from its frame to the board. A thin brass strip ¼-inch or wider is good for this. You can often drill and tap a couple of holes for mounting it to the board.

Note that in Figure 1, J2, J3, J4, and J5, as well as S2, are mounted on a plastic strip. This is because these phono jacks must have both "sides" (i.e., both sheath and center pin) above ground. The plastic strip is bolted to the inside of the metal face plate and 0.375-inch holes are punched in the face plate to completely clear the phono jacks. The switch just went along for the ride, as it could have been mounted on the metal face plate.

Except for the meter, C1, and the RF choke, I bought all the parts at Radio Shack. The RF choke came out of an AM radio. Anything from 1 to 2.5 mH will do. The chassis box is known to Radio Shack as a "project box," and is about 7½" L x 4¼" W x 2.375" deep. A metal chassis box could also be used. The entire FSM is built on the metal face plate. Simply turn the plate upside down on the box and you will have a convenient holder while you do the work.

For a dial, I used a piece of typing paper held down by a piece of thin, clear plastic. Since the FSM uses the source dipper's plug-in coils, you need an RF source for calibrating the dial. Some signal generators will work. Other options are the use of a friend's dipper or, if you want only the amateur bands, transmit into a dummy load and hold the field-strength meter nearby. As a last resort, you can wind a second set of plug-in coils for the FSM and calibrate it with the source dipper.

Since both the source dipper and the FSM use the same meter, I opted for a 200 μA job. You can use a Radio Shack 50 μA meter (now discontinued), but it is so highly damped that its response is too slow to suit me when using it with the dipper. It does work, but a less highly damped 200 μA meter is better.

Note that most of the circuit is built using phenolic terminal strips. A printed circuit could be equally good.

In Figure 1 you can see that there are both a low band (J2 coil and J3 antenna) and a high band (J5 coil and J4 antenna). Since brass strips are used in conjunction with J4–J5, the inductance is lower, and the FSM's range can be extended. Only the two hairpin loops are used in the high band section. Either antenna can be a two-to-three-foot "spike."

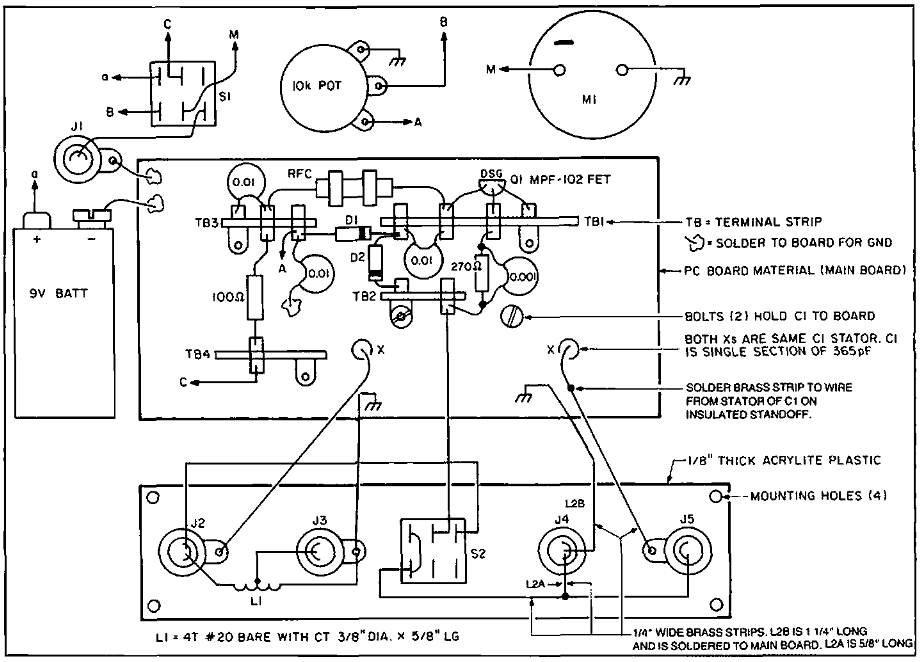


Figure 1. The sensitive field-strength meter. Note: For clarity, parts and subassemblies are shown only in approximate positions. J1 switches the meter to the source dipper. The shield lug of J3 is grounded to the main PC board as shown. Please note that the ground lead marked L2B should be a 1.25-inch-long strip of ¼-inch brass strip. L2A is ⅝" long. The points marked "X" are holes which pass insulated leads from the variable capacitor C1 stator.

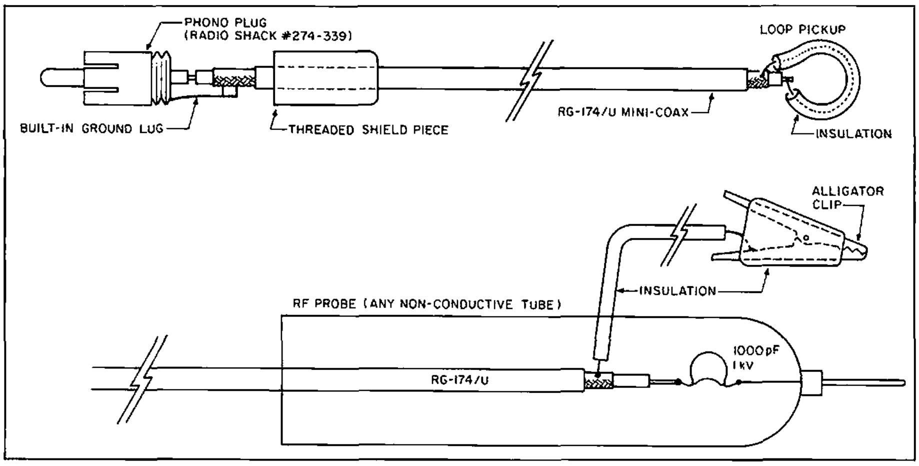


Figure 2. The RF sniffer (two options).

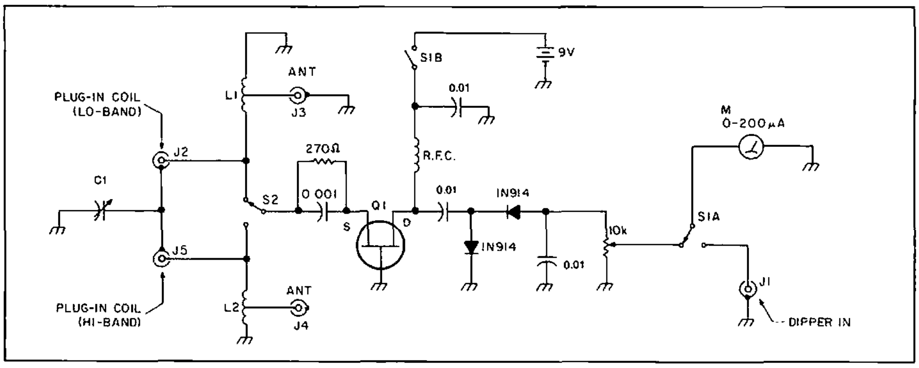


Figure 3. Field-strength meter schematic diagram.

To make a "hot-sniffer" out of the FSM, make a simple adapter, as shown in Figure 2. Using RG-174/U mini-coax, put a phono plug on one end and a small one- or two-turn loop from the center conductor to the braid on the other end. A second option here is an insulated probe that is capacitively coupled. Use a good high-voltage capacitor here! The braid should have a lead soldered to it with an alligator clip for a probe ground. Do not use a diode in the probe.

Since the meter, the 365 pF air variable, and the dial on my FSM were all "scrounged" or homemade, you will have to do the same (see the Parts List for a possible source of the capacitor). However, if you build the circuitry carefully on the plastic strip, the rest of the wiring is not the least bit critical. It is, of course, simply good practice both electrically and cosmetically to use short, direct leads whenever possible. Figure 1 does not show this, but that is because I used an exploded view for clarity. The 9-volt battery in Figure 1 is used only by the FSM; the source dipper has its own battery. Using separate batteries facilitates less switching and fewer interconnecting wires.

Make Your Tinkering Easier

Once you have the dipper and FSM built, operating, and on your workbench, you can investigate both active and passive circuitry. Large or small tank circuits can be checked with equal ease. Instead of repeatedly installing and removing a coil, you can get it right the first time with the dipper. The sensitive FSM will help you hunt down parasitics, check oscillators for output, verify that multipliers are working, sniff out RF leakage from the supposedly shielded chassis and... well—you will think of other uses, I'm sure. At any rate, this dipper and FSM combination will prevent a few gray hairs and add the most important item of all: having fun with your RF-oriented projects and/or troubleshooting!

The Source Dip Meter

A dip meter belongs on every ham's workbench. Before you install that tank circuit, the dipper will tell you what the tank's actual frequency is. A dipper will also ferret out "hidden resonances" for you. In a pinch, it can even be used as a signal generator. It can determine the frequency of antennas, and even the lengths of coax. The list goes on, making the dipper an extremely useful device.

This dipper uses a common FET as the active device and, aside from the variable capacitor and coils, it uses only one pot and six small parts. It uses the meter in the sensitive field-strength meter discussed previously, and shares its plug-in coils with the FSM. It is such a simple circuit that a beginner can easily build it. The only tools required are the usual ones: needle nose and diagonal pliers, a drill motor and a soldering iron. Except for the RF choke and the variable capacitor, all parts or suitable substitutes are available at Radio Shack.

If there is one glut on the market, it is the defunct so-called stereo, and this is where you can get the RF choke and variable capacitor. In fact, except possibly for the 10K pot, you will find all the other small parts in these old clunkers from the Orient. These little variable capacitors always have a number of tapped holes, so they are easy to mount. Just don't lose the original nuts and bolts—they are metric!

Some comments are needed regarding the variable capacitor. First, use a magnifying glass to determine whether the spacing of plates (rotors and stators) is the same on both sections. Take care because this difference in spacing will be subtle. The capacitor I used

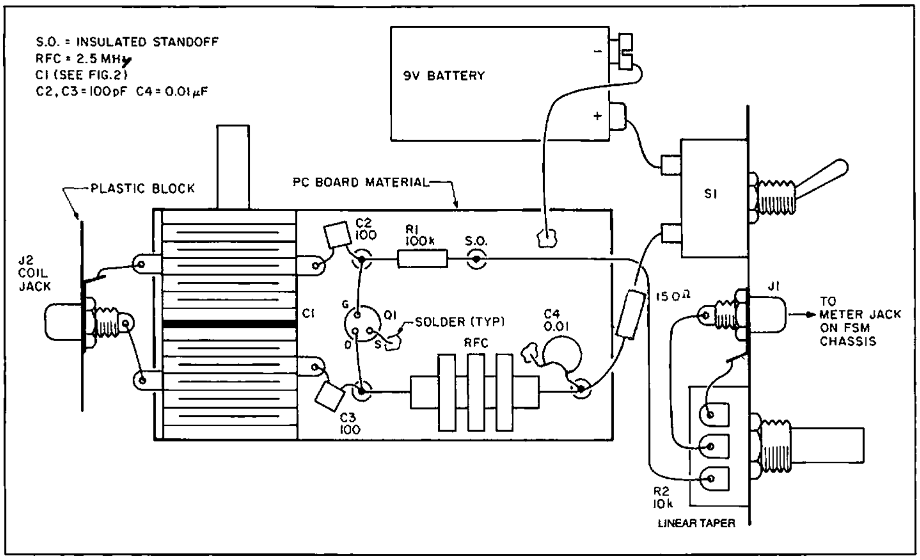


Figure 4. The simple source dip meter. Notes: For clarity, the off-board components are only in their approximate positions. The PC board is 3-9/16" L x 1-¾" W. The chassis box is 5-¼" x 3" x 2-⅛" (L.M.B. #780). J1 and J2 are Radio Shack phono types.

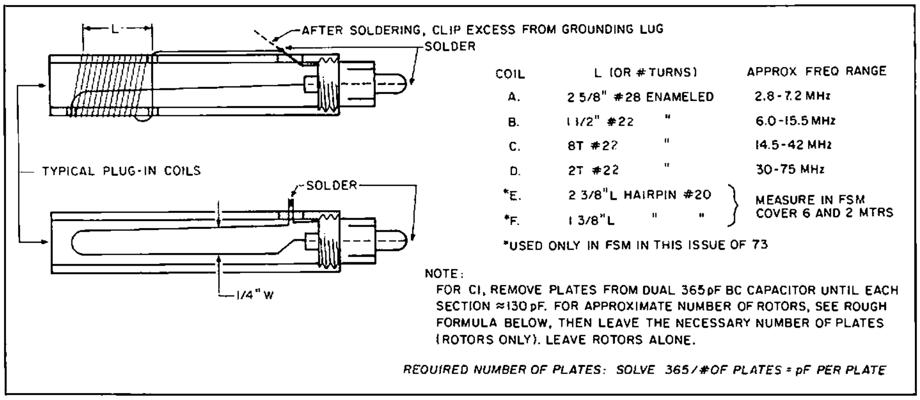


Figure 5. Dimensions of the coil forms. Note that coils E and F are used only for the field-strength meter. Use ½" o.d. Acrylite tubing (2-¾" long for coils A–E and 1-¾" long for coil F).

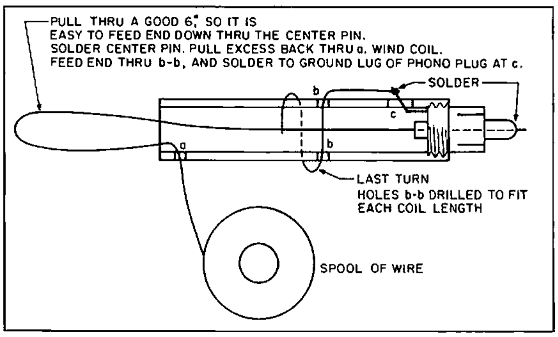


Figure 6. Winding details of the coil form.

required that only one plate be removed from the wide-spaced section, but seven plates had to be taken from the close-spaced section. The thing then becomes a dual 130 pF variable capacitor. If both sections are identical, you can use the approximate formula in the box in Figure 2. Above all, don't be concerned about hitting the 130 pF value on the nose; anything in the range of 100 to 150 or so will do just fine. *[Ed. Note: If you use the Antique Electronic Supply variable capacitor # CV-471, you need only use two of the three sections with no modifications; their model CV-240, although smaller, requires you to remove several plates in each section.]* This is because you have to calibrate your own dial, anyway. Exact ranges can be obtained by adding or removing turns on the plug-in coils. Have no fear—this is all very easy. By the way, you can remove or simply ignore the two small FM sections of these variables. I just bend their stator tabs down and solder them to the PC board as a board mounting method. If you remove those outer FM rotor plates, there is room on the front of the frame to drill and tap mounting holes (in case you did lose those metric bolts).

The plug-in coils use phono plugs, and both sides of the plug must be above ground. Therefore, I punched a 0.625-inch hole in the coil end of the mini-box to clear the phono jack. The latter is mounted on a 1½" x 1½" piece of acrylite plastic. When bolting on the plastic, be sure the phono jack is centered in the 0.625-inch hole, so the outer conductor of the jack is not grounded. Radio Shack's phono jacks come with a "grounding" lug. It is used here as a tie point for one side of the wires from the two sections of the variable capacitor, as is clearly shown in Figure 1.

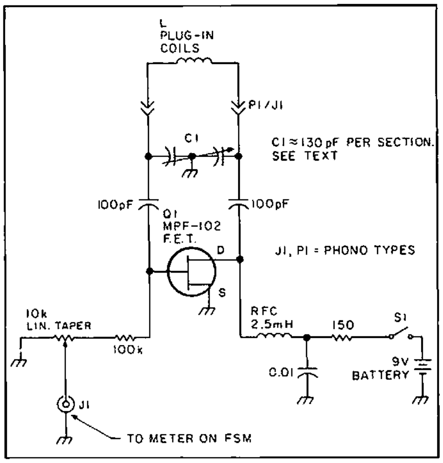


Figure 7. Schematic diagram of the source dip meter.

Wiring

For wiring the board, I used tiny insulated standoffs (phenolic terminal strips could be used as well) and a FET socket (optional). Of course, the ultimate way to go is to just etch a little printed circuit. The way I see it, you would only need six "islands," and they could even be located where my standoffs are! A small Z-shaped clip can hold the battery in place. See Figure 1 for details.

For the dial, I used a disc of ¼-inch thick acrylite clear plastic. The original knob on the capacitor had a brass insert with a setscrew, so I shattered the plastic off of the insert, then epoxied the insert into the plastic dial. No knob is used; the dial itself *is* a knob and offers superior control when tuning.

To achieve "one-hand" operation, a ¼-inch wide strip of coarse sandpaper is epoxied to the edge of the dial. The dial has a pair of 4-40 nuts and bolts 180 degrees apart on the outer rim, to hold on a piece of white poster board for the actual calibration marks. Use a friend's dipper or your own receiver to calibrate the dial. Do not try for too many numbers, i.e., 7.05, 7.06, etc. Use numbers only on every 1 to 5 MHz, and suitable marks between, for example: 7.0, 8.0, etc. Use pencil lightly for calibration. Then remove the poster board only—not the plastic dial. With the poster board removed, it is far easier to ink over the light pencil marks. If you use India ink, here's a little trick: Use black for all frequency marks except the amateur bands; use red for these bands. Then when your buddy borrows your dipper (and refuses to return it), he will find it easy and quick to use.

Winding the Coils

I used ½-inch Acrylite plastic tubing for the coil forms. See Figure 5 for dimensions for each frequency range. Note that all coils are used for the field-strength meter. However, coils E and F are not used for the dip meter. After cutting each coil form to the desired length, I drilled a 3.16-inch hole in the side of each coil form about ⅜-inch from the plug end. Now drill 1/16-inch holes at "a" and through the tube at the points marked "b," as shown in Figure 6. Holes "a" and

"b" mark the beginning and end of the coil itself. Hole "a" is drilled about a ¼ inch from the top end of the coil form in each case. See the chart in Figure 5 for the dimensions for each coil.

Next, mount an RCA phono plug in the end of each form. Use only the Radio Shack plug (RS# 274-339) with the metal shield. Remove the shield and toss it. Next, dab some epoxy on the threads of the plug and place it securely into the end of the coil form with the ground lug sticking through the hole in the side of the form as shown in Figure 5.

After the epoxy has set up, you're ready to wind the coils according to the chart in Figure 5. First, route the wire down the center of the coil form, through the center conductor of the phono plug, and solder it in place. Figure 6 shows the winding procedure. The last turn passes through the holes marked "b" and pulled down to point "c" and soldered in place on the phono plug's shield lug. Be sure to cut off the excess grounding lug. Being careful not to short the lug to the center pin, push the lug in a bit until it is about flush with the outside of the tube. It can be pried in and out several times without breaking. Once the coil winding is adjusted to the range you want, you can slip some heat-shrink tubing over the lower (plug) end, or for that matter, over the entire coil. Once the wire is fed through holes B–B, pulled tight and bent down to the plug's ground lug, the coil will not unravel. The dipper coils are all close-wound. You should use the #28 enameled wire for the lowest band's coil, but you can substitute #22 enameled wire for the #21 I used (because I had it). Note that, except for the lowest band coil, a few extra turns should be used as it is easier to remove than add turns when adjusting frequency. Be sure that when the coils are finished, there is overlap of the ranges. For example, the lowest frequency of coil C should be lower than the highest frequency of coil B. I always try to keep all of an amateur band on one range, to avoid having to plug and unplug coils.

My dipper is stable, easy to use, and gets more use than my old 110V Millen dipper. The source dipper has its own "power supply" and can go anywhere. Once you have one, you will wonder how you ever got along without it.

One note: Make sure you use the proper size of Acrylite tubing (½" o.d.) that will mate with the phono plugs. For the location of an Acrylite distributor, you can call Cyro Industries at (800) 223–2976.

If you can't find a source of the tubing, I can supply a full set of pre-cut and drilled coil forms with phono plugs permanently installed (send to address at end of article). These forms are suitable for many other purposes than these two projects. The package includes a pre-cut and drilled acrylite plate with the coil's jack permanently installed. The set is $39.95, including postage. If you can do your own drilling and epoxying-in of the phono plugs, the set of coil form parts is $29.95, including postage. 73

Contact Martin Beck WB0ESV at 1637 Hood, Wichita KS 67203.

Field Strength Meter Parts List

Q1	MPF102 FET (RS# 276-2062)
D1,D2	1N914 diode
S1,S2	SPDT switches
R1	10k panel mount potentiometer
R2	270 ohm resistor
J1–J5	RCA phono jacks (RS# 274-346)
RFC	1 to 2.5 mH RF choke (Antique Electronic Supply #PC-1535B)
TB1,TB2,TB3	2-terminal strips
TB4	4-terminal strip
BT1	9-volt battery
L1	4 turns #20 bare wire with center tap (⅜" diameter by ⅝" length)
L2	¼" wide brass strips mounted as shown in Figure 1
M1	200 µA panel meter
C1	365 pF variable capacitor (from AM broadcast radio or Antique Electronics Supply #CV-230)
C2	0.001 disc ceramic capacitor
C3,C4,C5	0.01 disc ceramic capacitor
Misc.	Case, mounting hardware, a ⅞"W x 4⅞"L Acrylite support plate (⅛" thick) and a 2"W x 4"L piece of single-sided PC board material for mounting components

Source Dip Meter Parts List

Q1	MPF102 FET (RS# 276-2062)
RFC	2.5 mH RF choke (Antique Electronic Supply #PC-1535B)
C1	Dual section 150 pF variable capacitor (Antique Electronic Supply #CV-900 or #CV-240)
C2,C3	100 pF ceramic disc capacitor
C4	0.01 µF ceramic disc capacitor
4	insulated standoffs
J1,J2	RCA phono jacks, RS# 274-346
R1	100k resistor
R2	10k potentiometer
R3	150 ohm resistor
S1	SPST switch
BT1	9-volt battery with clip
6	RCA phono plugs (for coils), RS# 274-339
Misc.	Battery clip, PC board material for mounting components (1¾"W x 3½"L), small plastic block (1.5" x 1.5") to support J2. ½ inch diameter Acrylite tubing for the coil forms. Lengths of #28, #22 and #20 wire for the coils.
Source:	C1 and the RF choke for both the Field Strength Meter and the Source Dip Meter are available from Antique Electronic Supply, 6221 S. Maple Ave., Tempe AZ 85283. Phone (602) 820–5411.

Safety Power Breaker For The Test Bench

Avoid a shocking experience.

David McLanahan WA1FHB

When setting up a test and service bench, safety often gets short shrift. Most of our equipment, both test and working, operates from potentially lethal 117-VAC. To coin a cliche, "familiarity breeds contempt." Even neglecting the hazard to life or limb, the only way to limit further damage to equipment in a memorable minority of failures is to remove all power from the circuit RIGHT NOW. Yet, many service benches are cat's cradles of power and signal connections with a maze of switches and controls—certainly not conducive to fast, effective emergency action when something unpleasant starts.

The Big Three

The most important attack on this problem is forethought. As in defensive driving, you must tinker defensively. Observe the following three rules:

1) Set up hypothetical danger situations and come up with responses to them ahead of time. "What do I really need to do fast if something happens?"

2) Know who plugs into what in a specific test setup, and how both AC and DC are fed to the various units involved.

3) Know the location of the "most definitive" OFF switch; how to reach it; and, ensure a clear path to it. Check this often, particularly when working with new, partially defective, or questionable equipment.

The Added Edge

This thinking is more valuable than any hardware, but there is a hardware device to help—a safety-wired 117-VAC relay or "contactor" whose coil is powered from its load side with several normally-closed (NC) "panic" switches in series (see figure). With this configuration, opening any one (or more) of the panic switches, even just momentarily, will turn off the current solidly, and you have to intentionally reset the system to restore power. (Of course, this will not disable such sources as batteries or big capacitors on the bench...)

To get the benefit from this device, be sure that it is the sole power source for all equipment on the bench, especially for any dubious units you are working on. You don't want it to serve any room lighting. All you need is to have something exciting happening with, perhaps, a small fire starting, and then find yourself in total darkness!

The panic switches can be any normally closed types, either momentary or sustained (I prefer momentary so I don't have to check them to reset), rated for 117 VAC at the coil current. Suitable examples are some nice big red-button industrial ones that sometimes show up on old equipment in junk yards.

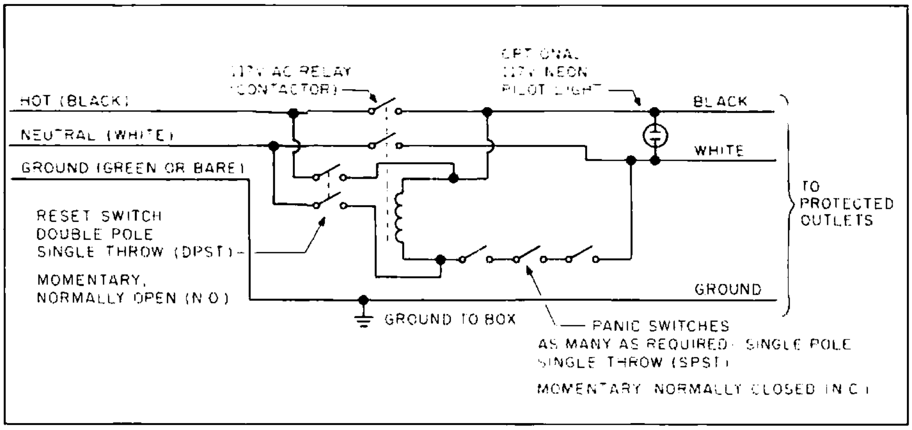
Where To Put the Switches?

Give thought to where and how to mount the switches. One or two should be easily accessible but slightly protected on the test bench. I'd put one—large, obvious, and completely unprotected—just inside each door to the room. It's also possible to have a switch on a hinged pipe "kick bar" along the length of the bench. Don't forget to explain the system to family, co-workers, or technical guests, so they can activate it if they witness a problem while you have your hands full of probes. The reset switch, on the other hand, can be in an obscure place, perhaps on the relay box, and well protected.

Because of the cost of new contactors, you may want to look for a used one at a hamfest or tag sale. There's nothing critical about it, but if you have a choice of several, energize the coil of each and pick the quietest. Some of them make quite a buzz. To determine the required current capability, add up all the loads you might ever want on-line at once and double the figure to find a reasonable minimum capacity to look for.

When you find a unit, check out the contacts for pitting, and check the coil voltage on the label. If it's not 117-VAC, you'll need a small transformer to power it. There are many nice little solid-state AC switching modules that would work nicely here. In this application, however, it's a good idea for the power circuit to be physically broken by an air gap.

Both for safety and to conform with the National Electrical Code, mount the relay in a sturdy metal box (called a "NEMA" box), available from your local electrical supply outlet. The input power can be taken from



The safety-wired 117-VAC relay or "contactor." Opening any one (or more) of the panic switches, even just momentarily, turns off the current.

any unswitched 117-VAC outlet (or hard-wired) and goes only to the the relay input contacts and the reset switch. Connections from the relay output contacts fan out to the protected outlet boxes and other equipment, as well as back to power the relay coil.

In doing this wiring, preserve the color code (black and white) through the relay contacts. In other words, when the relay is closed, make sure that the black wire going in connects to the black wire (and not the white) coming out. The ground wire (either bare copper or green insulation and connecting to the round ground pin on the power plugs) is never opened by the relay. It connects solidly to the relay box as well as to the ground connections to the outlet boxes.

There are several other enhancements you can provide for your power distribution system. The cheapest and simplest would be three GE Metal Oxide Varistors, MOVs, that will peak-limit damaging high-voltage transient spikes on your household power line. The next enhancement would be line filtering—reducing some of the high-frequency (but lower voltage) garbage on the line.

Another safety enhancement would be a ground fault interrupter (GFI) that would disconnect the power if it found current returning through the green or bare ground wire. The last enhancement is to fuse- or circuit breaker-protect, according to the dictates of your conscience. Fuse and breaker protecting is another whole subject, but there's a small tip I'd like to insert here: Most of the breakers available from local electrical suppliers are thermal with large ampacities, intended to prevent fire in the household wiring. Electronic and surplus sources are apt to have magnetic breakers (faster acting) in smaller ampacities. I devote an individual fuse or breaker to each major piece of equipment that normally resides on my test bench.

Unless I don't want the unexpected shutdown of a piece of equipment, I'll fuse- or breaker-protect it at about 110% of its current rating, rather than the more customary 150 to 200%. That way, in the event of a problem in the protected equipment, the fuse or breaker will pop as a warning before the smoke starts, and there may be less secondary damage.

The "self-fed" contactor scheme outlined here has one additional benefit: Most modern electric power distribution systems (electric companies) use "reclosers." These are sophisticated circuit breakers that, on experiencing an overload and opening, automatically "try again" several times, reapplying power to see if the fault might have cleared. The problem with this for us is that the repeated switching of the electricity off and on can be stressful to many kinds of electro-mechanical devices. With the self-fed contactor, your equipment will not be subjected to the retry switching; it will go off on the first failure, and stay off until you reset the contactor.

Safety may not be an interesting or exciting topic as ham radio endeavors go, but along with increasing our ranks by selling ham radio to new converts, it pays to protect the hams we already have. 73

An Improved Crystal Tester

Check out those surplus crystals with this portable circuit.

by Larry G. Ledford KA4J

Wayne Green's book *Practical Test Instruments You Can Build [currently out-of-print]* contains a very useful circuit for a crystal tester developed by Mike Kaufman. It's a good, simple, portable and very handy test item. But with a few modifications it can be made better.

Modifications

See Figure 1 for the original circuit. If you are building this from scratch, be advised that plastic 2N2222s (the ten-for-a-dollar at any hamfest variety) will work very well in place of 2N3607s.

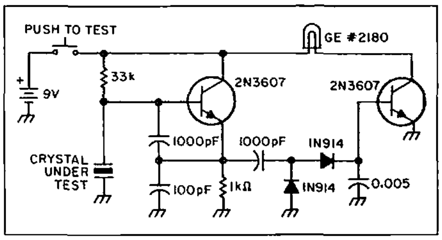


Figure 1. Original crystal tester circuit.

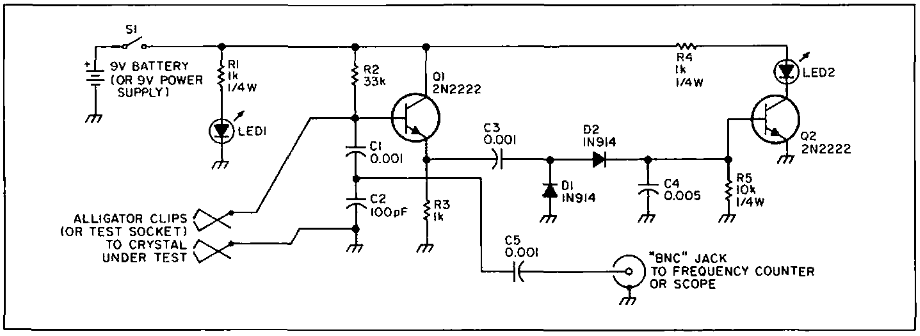


Figure 2. The improved crystal tester.

The first change is to replace the incandescent bulb used for a go/no-go indicator with a light-emitting diode and current limiting resistor. When I did this, the LED switching transistor would "latch" on so I added a 10k resistor from base to ground for a cure. Apparently the transistor had sufficient bias to turn off the higher current of a bulb, but would allow a lower current LED to stay on.

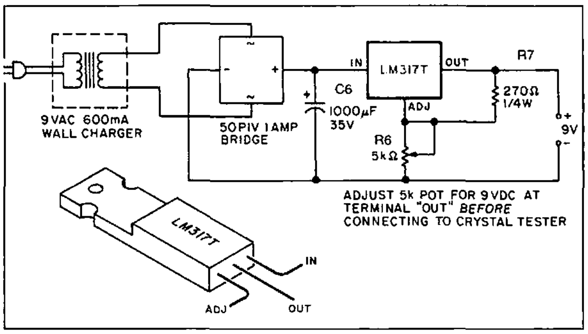


Figure 3. AC power supply for the crystal checker.

The next mod is to add another LED and resistor to act as a very simple battery indicator. If the battery were low (or dead), you'd never get a "good" crystal indication and you might discard a non-defective crystal. If the power LED lights but the crystal's "good" LED doesn't, you can assume the crystal is bad! Although you could mount several different crystal sockets on your tester, I used two alligator clips on short leads that will fit any crystal.

The last modification is to add a capacitor and BNC connector so that a counter or scope can be hooked to the oscillator for rough frequency checks. Bear in mind that this circuit will not be the same as the circuit that the crystal will be used in, so the frequency will be different. However, it will give you an idea of where you are.

Due to the lack of any tuned circuits, third overtone crystals will oscillate on their fundamental frequency. It may take some work with pencil and paper to see exactly what frequency a receive crystal is on. You can also plug a short antenna or wire into the BNC jack to loosely couple it to your receiver.

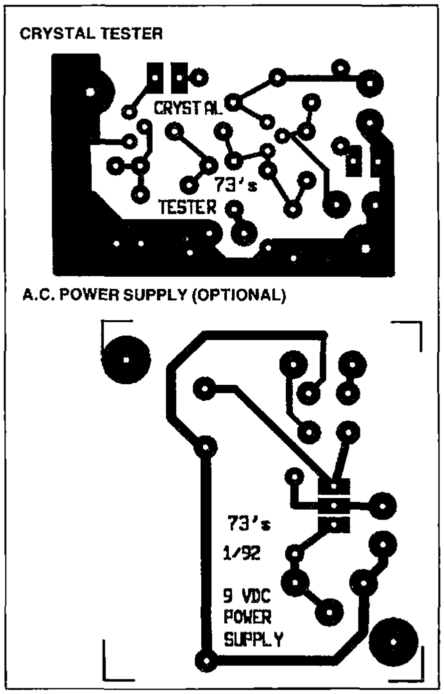


Figure 4. PC board foil pattern.

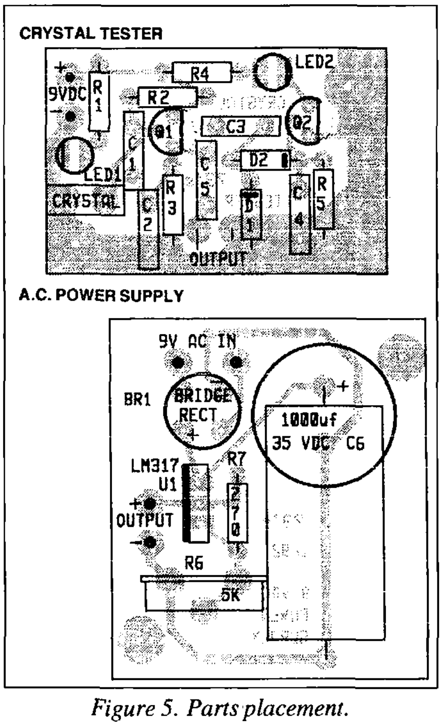


Figure 5. Parts placement.

Continued on page 26

73 Book Review

by Brian Robinson N3GDE

Secrets of RF Circuit Design

Secrets of RF Circuit Design
by Joseph J. Carr
First Edition, 1991
TAB Books
Blue Ridge Summit PA 17294-0850
Hardcover, 405 pages
Price Class: $20

The name Joseph J. Carr should be a familiar one for any frequent reader of electronics magazines. Mr. Carr has a new book out that is an excellent introduction and reference for anyone interested in radio.

Secrets of RF Design was written to remove some of the mystery from a field that has often involved a lot of "black magic." Mr. Carr has documented many of the practical design and construction practices required to make circuits work at RF frequencies. The book is full of the required theory, but it also includes many practical hints and procedures that can mean the difference between a circuit operating or not operating.

The book begins with an introduction to RF electronics, and starts with explanations of the factors that cause circuits to operate differently at RF frequencies, such as stray inductance and capacitance, the skin effect, and stray coupling. There is plenty of material on variable capacitors, varactors, and inductors, as well as design and construction information for building your own inductors and RF/IF transformers. Hams and shortwave listeners will be especially interested in the mechanical filter IF amplifier project.

There is ample information covering receiver and preselector circuits. This information is especially suited for people who want to design and build their own receivers, but it is also appropriate for anyone who wants to learn more about how receivers work, and the advantages and disadvantages of various features. As the author states, the material presented will allow you to successfully "roll your own" designs.

Not Just Circuits

The title of the book is somewhat misleading. While there is plenty of the circuit-level material as described above, there is also a lot of RF systems-level material, including chapters on propagation, interference, antenna design and construction, emergency antennas, frequency drift problems, and lots of information on test procedures and equipment. Those interested in older equipment will find several chapters on choosing and rehabilitating old receivers, transmitters, and signal generators.

There is a great deal of information oriented towards service and troubleshooting, including simple build-it-yourself signal generators and an RF noise bridge, and a whole chapter on alignment techniques.

Plenty of information is included for UHF and microwave fans. Three chapters are devoted to microwave diodes and negative resistance devices, UHF/microwave transistors, and UHF/microwave ICs.

The level of the material spans a wide range. Some of the material is presented on a very basic, introductory level, and much of the text is very straightforward and practical. However, other sections, particularly those covering negative resistance devices and propagation, are quite advanced. Readers will encounter a pleasantly wide variety of both practical and theoretical information.

Interesting historical information is presented both on its own and to illustrate various technical topics.

The book also devotes a separate chapter to the W4UCH "Poor Man's Spectrum Analyzer," and provides useful information for anyone who has or is considering one of these interesting pieces of equipment. There are also chapters on building your own time-domain reflectometer, and on a frequency counter module that the author finds especially useful.

The book presents a broad range of useful material. It is appropriate for anyone who wants to design and build his or her own radio circuits, repair and refurbish old equipment, or who just wants a better understanding of the circuits, features and systems used in radio communications.

The book includes a chapter of BASIC antenna programs for antenna design. The programs are also available on disk from the author. 73

Secrets of RF Current Design *is available from Uncle Wayne's Bookshelf.*

Number 8 on your Feedback card

73 Review

by Gordon West WB6NOA

Standard Amateur Radio Products, Inc.
P.O. Box 48480, Niles IL 60648
Tel. (312) 763-0081
Price Class: $345

The 200-Channel Standard C168A Handheld

Lots of options in a small, small package.

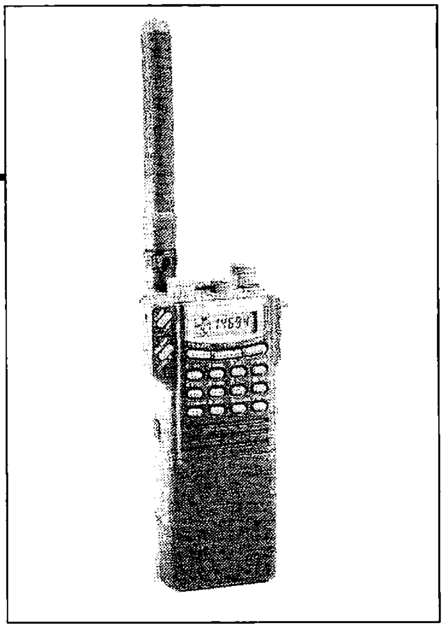


Photo A. The Standard C168A.

Standard VHF and UHF transceivers are back. The "Standard" name may be new to you, but Standard Communications, a Division of Marantz Japan, Inc., has been building quality VHF and UHF ham, land, and marine transceivers for over 25 years.

In fact, it was 22 years ago that this author introduced the ham community to the world's first Japanese-built, 2-meter, 5-channel, crystal-controlled handie-talkie. What a weekend to remember—everybody with a Motorola HT-220 thumbing their noses at this Japanese rig. Few hams felt that the 2-meter band would ever be popular, and even fewer professional radio operators dreamed that Japan could ever produce any type of equipment comparable to good ol' U.S.A. gear.

How times have changed. Standard Communications Corporation in Salt Lake City, Utah still continues to be the leader in land mobile and marine VHF and UHF equipment, and well-known entrepreneur Roger Wayman W9TYT heads up Standard Amateur Radio Products in Niles, Illinois. The Standard line originally re-debuted under the Heath label; now Roger has brought back the VHF and UHF hand-held, mobile, and base units under the Standard label.

Just as Advertised

The Standard C168A (the "A" stands for the "American" version) 2-meter handheld is advertised as the "world's smallest full-keyboard handheld." Smaller than some of the other brand-new micro series 2-meter handhelds? Yes, it is. Yet this scaled-down size handheld still possesses all of the features found on larger equipment plus reasonably sized, rubberized keypad buttons for soft-touch commands.

The 2-meter set comes with a long-life, 700 mA battery pack, and a little overnight wall charger that lights a red LED when it's plugged into the pack. The wall charger feeds the battery direct, so if you're dealing with a reasonably full battery, you can run the unit and charge the battery at the same time. It's about "push" when it comes to getting the battery charged with the unit on, but turn the unit off and by daybreak your pack will have a full head of steam.

Controls include volume, squelch, remote mike and ear jacks, along with the BNC connector for the antenna and a frequency and channel-changing knob. They have a nice rubberized feel to them, and they're far enough apart to make knob-twirling a breeze. I also liked the recessed LED that glows red on transmit, and green with open-squelch activity. This is handy when a radio goes off at a hamfest—you can look down and see whether or not it's yours.

The LCD display on the front is small, like all other pint-sized handhelds, but it's completely readable at an oblique angle. If you hold your head just right, you can also read it with polarized sunglasses, too!

Audio, Power Usage, and Heat

Audio output was tested at 200 mW, which is okay for normal operation, and about "standard" for other small handhelds. The speaker gave us reasonable audio output, and its full fidelity made listening to the recovered audio pleasant. There are other handhelds with slightly louder audio output, but the audio tends to be a bit tinny, and at low volume not as pleasant as the Standard audio. But in a crowd, sharp, tinny audio output is sometimes desirable.

Standard has a variety of headsets and speaker microphones to take care of operating in a crowd. Two different models of headsets let you walk around in a crowd and look like a goon—but for good, solid communications, the goon-look is really one of the best ways to go to hear and be heard.

One interesting feature allows you to remote the battery via a curly cord down to your belt, and you wear the actual transceiver on your shoulder. This gets that antenna up out of your gut, and makes you look like a New York cop with great sounding audio right next to your ear. It also gives you the capabilities of complete control of your handheld at eye level.

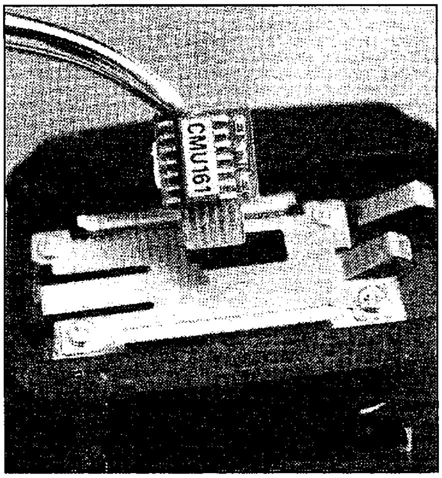


Photo B. The 40- or 200- memory-channel board simply plugs into the bottom of the HT. The memory is always retained.

If you plug your Standard C168A into 12 volts, you can get a little over 5 watts out of the antenna jack. This is a good way to boost your power for mobile use for a quick conversation. Real quick.

Anytime you run a micro-sized portable at 5 watts, it's going to get real hot fast off of 12 volts. Real hot, and real fast—after about four minutes of key-down. But Standard did its homework, and the power output begins to fold back, protecting the output transistor from thermal meltdown.

Selectivity and rejection of out-of-band pager, weather, and taxi cab calls, was judged adequate. On an outside antenna, it gave us a few more squawks than some larger handhelds with (probably) more band pass circuitry in the RF section. But with its reasonable selectivity, the Standard 2-meter handheld turns out to be a dandy AM/FM full-sensitivity scanner from the air band at 115 MHz to FM narrow band frequencies to 175 MHz. And for those of you who are members of the Civil Air Patrol, MARS, or the U.S. Coast Guard Auxiliary, word has it that modification capabilities for transmit are available WITH PROPER CREDENTIALS.

The Standard also contains all those neat bells and whistles that not many hams use, but every ham wants—such as DTMF paging, DTMF group calls, tone burst for European repeaters, and seven different types of scan,

with three modes of scan and multiple scan speeds. Very good news—CTCSS encode AND DECODE is "standard" with Standard. With more repeaters going over to PL, it's hard to understand why their competition would still make CTCSS an option.

Programming

Programming the Standard is unlike programming any other 2-meter handheld. With the Standard equipment, you program in layers. For example, first you punch in the repeater output, and program it into any one of 40 memory channels. Then you go back and program the offset and the PL. This is layered on top of that original simplex frequency entry, and stays in memory until you go back and change it. And you don't need to worry about accidentally erasing a memory already programmed—a unique set of keystrokes makes accidental write-over impossible; you must deliberately write over what you want to change.

Once you master the concept of layering in the information for each memory channel, it programs up just as fast as any other handheld out there. But it is different from what you might be used to, when you first start poking away at the rubberized keypads.

Memory Unlimited

But here's the neat thing with the Standard C168A—you can pull out the plug-in 4K EEPROM memory cartridge, and plug in a 16K EEPROM memory cartridge for 200-channel storage! Or, if you're like me and can't remember what you've stored in 200 channels, you could have: several sets of 4K EEPROMs for different geographic regions of the country, or plug-in EEPROMS for 40 air scanner, marine, or repeater channels in different cities. Each PROM retains its memory after you unplug it. When you travel, you can just pick the appropriate PROM and plug it in. But you have to do the initial programming yourself. No one has cloned the *ARRL Repeater Directory* yet by geographic area in the standard or 16K PROMs.

I run the 200-channel PROM and divide up my frequencies by banks of 20 for different cities. This gives me 10 different banks of 20 channels each, and if I need more, I'll simply buy another $30 200-channel EEPROM from the factory. They are readily available.

Ham radio dealers should cash in on this feature by offering preprogrammed EEPROMS. It takes a maximum of two minutes to clone from one Standard set to another. Just think, Mr. Dealer, of all the time you can save when selling that next 2-meter transceiver—you won't have to stand there for 20 minutes, programming in some popular frequencies for your particular area on this new hand-held set.

Standard has a 440 MHz UHF model, the C468 (for about $370), which I got my hands on. It's also a good performer. Like the 2-meter set, the big advantages are ultra-compact size, reasonably good audio out, out-of-band scanning capabilities, and the incredible memory expansion EEPROM capabilities.

So, welcome back, Standard. We look forward to some of that exotic equipment we see advertised in some of the Japanese magazines. The new dual-band mobiles look good, and that triband base station, along with the scanner spectrum analyzer, is also a long-awaited product here in the U.S.A. ■

The Standard C168A HT
Test Bench Report

TX power output (High, with included battery): 2.2 watts at 950 mA.
Second harmonic: −92 dB
Frequency accuracy: +094 Hz
Peak deviation: 4.8 kHz
In-band receiver sensitivity: 12 dB SINAD, 0.102 μV
Selectivity (±15 kHz): 32 dB
Selectivity (±20 kHz): 60.4 dB
Intermodulation rejection: 63 dB
Image rejection: 73 dB
Heat sink capabilities: Good, using diecast aluminum frame.
Best feature: Ability to plug in EEPROM for 200-channel capability.
Least desirable function: Must read instruction manual several times to figure out how to program a memory sequence.
Distribution: Available from leading amateur radio dealers throughout the United States.
Availability: Off-the-shelf, including 27 different accessories.

An Improved Crystal Tester

Continued from page 22

See Figure 2 for the improved circuit. If you power the tester with a 9-volt battery, it will make a very handy portable test instrument. It's especially useful when rummaging through those bins of surplus crystal at a hamfest or surplus store.

For a more permanent setup, you may wish to run the tester from 110 volts AC. I built the power supply shown in Figure 3 for mine. ■

Contact Larry G. Ledford KA4J at 553-4th Street S.E., Cleveland TN 37311.

Parts List

Q1,Q2	2N2222 transistors
D1–D4	1N914 diodes
LED 1 & 2	Red LEDs
R1,R3,R4	1k, ¼W resistor
R2	33k, ¼W resistor
R5	10k, ¼W resistor
C1,C3,C5	0.001 μF capacitors
C2	100 pF capacitor
C4	0.005 μF capacitor
S1	SPST switch

Misc: XTAL sockets (optional), 9V battery, mini alligator clips (2), PC board, case, battery clip.

A blank PC board for the XTAL tester is available for $3 + $1.50 shipping/handling per order (the optional power supply board is $3.50) from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Build a Function Generator

An inexpensive way to generate useful waveforms.

by J. Frank Brumbaugh KB4ZGC

Function generators provide a number of different waveforms over the audio frequency range and, if you pay enough, up to about 2 MHz or more. Commercial units are priced well over $100, a very high price for what can be a very simple instrument.

Hams do not need a broad frequency range, nor do they have to spend big bucks for a perfectly adequate function generator covering the most important audio frequencies, at least 300 to 3,000 Hz or a bit higher. But they may need a number of different waveforms, depending on the tests they require.

The function generator described in this article covers from below 300 Hz to above 7,500 Hz in two ranges. It provides positive pulses, negative pulses, square waves, triangle waves, and sine waves at all frequencies within its two ranges. Best of all, it requires only a single inexpensive IC and a general purpose NPN transistor. It can be constructed for less than $5, not including an enclosure, even if all parts must be purchased new (surplus).

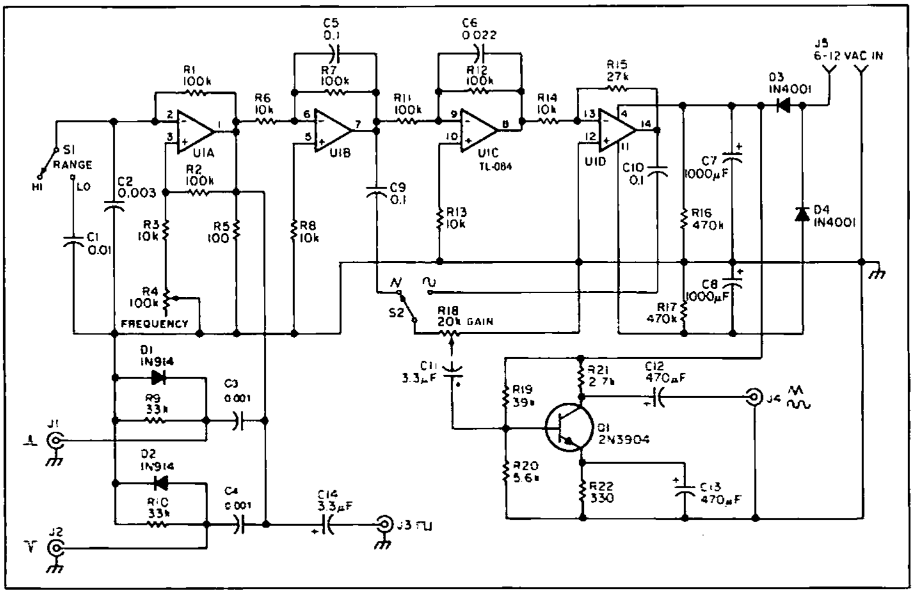


Figure 1. Schematic diagram, function generator.

The Circuit

Figure 1 shows the schematic diagram. U1 is a TL-084 quad FET op amp that is connected with external components to generate square, triangle and sine waves at frequencies controlled by *frequency* potentiometer R4. Positive and negative pulses are derived from the square waves.

There is a minor drawback resulting from trying to do so much with so little, but this is eliminated by adding Q1, a 2N3904. Triangle and sine waves generated by U1 vary inversely in amplitude as frequency is changed. Q1 amplifies sine and triangle waves with the input level controlled by *gain* potentiometer R18. Lowering the frequency reduces their amplitude; raising the frequency provides more gain. This allows you to keep these waveforms at a constant amplitude and eliminates distortion at low frequencies.

Although this circuit requires both positive and negative voltages, the total current drain is so low—a few milliamperes—that a simple voltage doubler consisting of diodes D3 and D4, electrolytic capacitors C7 and C8, and voltage equalizing resistors R16 and R17, does the job. A small wall transformer, or any small low voltage transformer with a secondary voltage between 6 and 12 volts AC, is used to power the function generator. One side of the secondary is the center tap of the voltage doubler circuit and is grounded, thus both positive and negative DC voltages referred to ground (common) are provided, eliminating the need for a complex positive and negative power supply.

Construction

I recommend a small printed circuit board, such as Radio Shack 276-150. All parts except jacks and controls are mounted on the PC board. The layout is not critical, despite the rapid rise and fall times of the square waves. You don't need any shielded wire.

The PC board can be mounted in a small metal or plastic enclosure, or one made from printed circuit board material. Both the potentiometers and the toggle switches can be mounted on the panel, along with the four waveform output jacks. The AC connector can be mounted wherever desired. It must match the low voltage AC connector from the wall transformer.

If desired, a small step-down transformer with a secondary of 6 to 12 VAC can be mounted in the enclosure if a wall transformer is not used. If you do this, an SPST toggle or slide switch should be used in series with the primary to serve as an on/off switch. If you want a pilot light, connect an LED in series with approximately 12,000 ohms, 2 watts, across the transformer primary. Two-watt resistors are scarce today. If you do not have one in your junk box you can use a pair of 27k, 1W resistors; four 47k, ½W resistors; or eight 100k, ¼W resistors, wired in parallel to substitute for the 12k, 2W resistor.

Although calibrations can be marked directly on the panel, it will look better if you use a circular calibrated dial. You can make an excellent dial using an aluminum or steel circle left over from cutting a hole for a meter or small speaker. (You *do* save these in your junk box, don't you? If not, you'll have to cut one the correct size.)

Paste white card stock to one side of the circular dial. Allow it to dry thoroughly before trimming the excess card even with the dial plate. Enlarge the center hole if neces sary so the dial will just clear the shaft of R4. Fasten the dial plate to a knob, using super glue or epoxy. Place the dial over the shaft and tighten the setscrew(s) in the knob.

All parts except the printed circuit board and transformer are available from Short Circuits, PO Box 285, Barnegat NJ 08005, at unbelievably low prices. Small inexpensive power transformers are available from Micro-Mart, 508 Central Ave., Westfield NJ 07090. (Cat. No. T-11 provides 10.6 VAC at 175 mA for $1.50.)

Calibration

A frequency counter is recommended for calibrating the frequency dial. It must be capable of measuring frequencies below 300 Hz. Some of the frequency counters which have very broad measurement ranges require use of a low-pass probe for frequencies below about 20 kHz. Figure 2 shows the schematic for a simple low-pass probe which will work with any frequency counter.

Rotate the dial (R4) fully counterclockwise to maximum resistance. Set RANGE switch S1 to LOW. Connect the square-wave output (J3), through a low-pass probe if used, to the frequency counter. Set the frequency counter to a one-second gate period. Apply power to the frequency counter and the function generator.

Note the frequency displayed. It should be a bit below 300 Hz. If the frequency displayed is higher than about 500 Hz and you are *not* using a low-pass

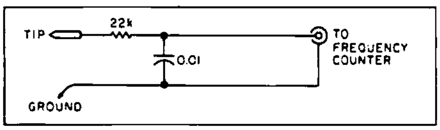


Figure 2. Low-pass probe.

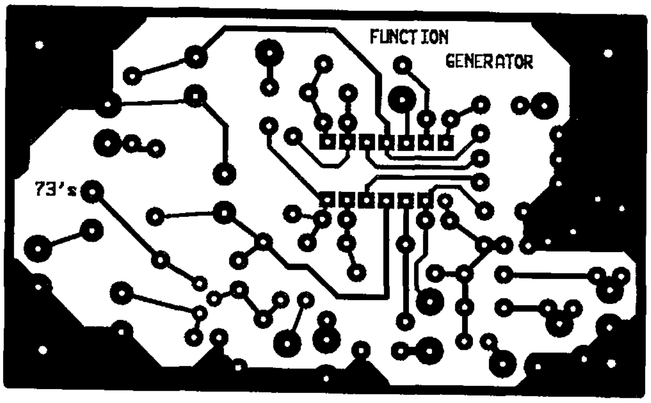


Figure 3. PC board foil pattern.

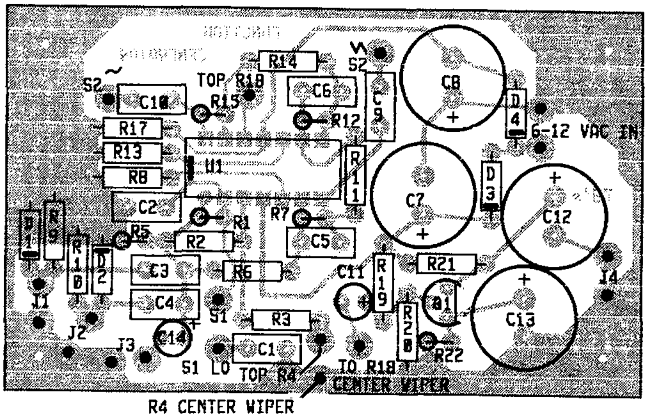


Figure 4. Parts placement.

probe, both the positive and negative edges of the square wave will be counted, displaying double the actual frequency. If this occurs, either divide by two or use a low-pass probe.

Rotate the dial until a frequency of 300 Hz is displayed. Mark the dial at this point. Continue calibrating the dial as described until the entire low range has been calibrated. Then move the range switch to HIGH and calibrate the high frequency range.

The dial will not be linear with frequency. Lower frequencies on both ranges will be spread out and high frequencies compressed. However, these ranges overlap so the compressed high frequencies on the LOW range are spread out on the low end of the HIGH range.

Operation

Apply power to the function generator. Set the dial and RANGE for the desired frequency. Pulses and square waves are available at all times. A choice of triangular or sine waves at J4 is controlled by S2, and their amplitude controlled by gain control R18. Both triangle and sine waves should be observed on an oscilloscope when setting the gain control. Too high a gain at low frequencies can result in greatly distorted waveforms.

Conclusion

The function generator is a general purpose instrument. A few of the more common uses are:

•*Pulses*: External triggering of oscilloscope. Checking electrical length of coaxial cables. Measuring carrier lifetimes of diodes.

•*Square Waves*: Checking low frequency limits of amplifiers. Vertical amplifier voltage calibration of oscilloscope. Output can be keyed into a speaker or headphones for code practice. Signal injector in receiver tests.

•*Triangle Waves*: Bi-directional sweeping of a voltage controlled oscillator.

•*Sine Waves*: Checking bandpass or bandstop characteristics of active and passive filters. Measuring frequency limits and insertion losses of active and passive filters. A known modulation source for transmitter testing.

The methods and techniques for using various waveforms for testing and evaluating circuits and equipment are explained in a number of textbooks, and detailing them here is far beyond the scope of this article. When you become familiar with the function generator you will discover many more uses for it in the shack. 73

Contact J. Frank Brumbaugh KB4ZGC at 1812 Marilyn Ave., Bradenton FL 34207-4743. Please enclose an SASE.

Parts List

C1	0.01 µF 5% mylar or polycap
C2	0.003 µF 5% mylar, polycap or monolithic
C3, C4	0.001 µF ceramic disc
C5	0.1 µF ceramic, polycap, mylar or monolithic
C6	0.0022 µF mylar, polycap or monolithic
C7, C8	1000 µF 25 VDC electrolytic
C9, C10	0.1 µF disc ceramic or monolithic
C11, C14	3.3 µF 16 VDC electrolytic
C12, C13	470 µF 25 VDC electrolytic
D1, D2	Silicon switching diode (1N914, IN4148, etc.)
D3, D4	Silicon rectifier diode 1N4001
J1, J2, J3, J4	RCA or phone jack
J5	AC connector to match wall transformer output
Q1	NPN small signal transistor (2N3904, 2N4124, etc.)
R1, R2, R7, R11, R12	100k 5% ¼W resistor
R3, R6, R8, R13, R14	10k 5% ¼W resistor
R4	100k potentiometer
R5	100 ohm 5% ¼W resistor
R9, R10	33k 5% ¼W resistor
R15	27k 5% ¼W resistor
R16, R17	470k 5% ¼W resistor
R18	20k potentiometer
R19	39k 5% ¼W resistor
R20	5.6k 5% ¼W resistor
R21	2.7k 5% ¼W resistor
R22	330 ohm 5% ¼W resistor
S1	SPST toggle or slide switch
S2	SPDT toggle or slide switch
U1	TL-084 quad FET op-amp

A blank PC board is available for $6.25 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

73 Review

by David Cassidy N1GPH

The Ventenna

The "no antennas" antenna.

The Forbes Group
P.O. Box 445
Rocklin CA 95677
Tel.: 1 (800) 551-5156
Price Class: $40

One of the biggest problems faced by many hams is how to operate from an apartment or condominium. There are entire communities that restrict all outside antennas, and even a simple dipole or 2 meter vertical could be a violation to restrictive zoning laws or deed covenants.

Of course, hams should check out this kind of stuff before renting or buying a home, but let's face it—amateur radio isn't always the prime factor in choosing where to live. There are thousands of amateur radio operators who find themselves with very limited options: indoor antennas (TVI problems and often poor performance), mobile operation (fun, but limiting) or going QRT (yikes!).

The Forbes Group has come up with an ingenious way for those in a "no antenna zone" to get around restrictions, and still get out a decent signal on the UHF/VHF bands. It's called the Ventenna.

What's a Ventenna?

As it comes from the manufacturer, the Ventenna is a strange looking thing—until you understand how it goes up. When you take it out of the box, what you see is about 3 feet (2 meter version) of ABS pipe with a coax tail sticking out 6 inches from the bottom.

That's what you see. What you've got is an efficient 2 meter (also available in 220 and 440 MHz versions) antenna that looks exactly like a common vent pipe. These vent pipes (or "stink pipes," as they are sometimes referred to) grace the rooftops of millions of homes all over the world—even homes that have restrictions against any outside antennas.

installing the Ventenna

The first thing you want to do is take a walk down your street and notice what the vent pipes in your area look like. Are they "raw" ABS pipe (with the manufacturer's stenciling still showing), painted black, or are they painted to match the house or roof color? If the pipes in your neighborhood are raw ABS, you're all set, because the Ventenna comes in this form.

If the pipes in your area are painted, visit your local hardware store and buy a can of spray paint in the right shade. While you're at it, pick up a can of paint that matches the color of your roof. Are the shingles gray, brown or blue? Take a sample with you to the hardware store and try to find the best match possible.

A couple of quick coats with fast drying spraypaint should be sufficient. If you want to get really sneaky, sprinkle some sand on your freshly painted coax so it resembles the texture of your roof shingles even more. For truly cloak-and-dagger type installations (if you own your home), drill a small hole in your roof next to your vent pipe, placing the hole so that it is hidden by the pipe when viewed from the street. Run your coax into this hole and seal with a waterproof sealent.

The inside diameter of the Ventenna is slightly larger than the outside diameter of your vent pipe, so it slips right over your existing pipe. Tighten the three set-screws on the bottom of the Ventenna (a dab of matching paint helps hide the shiny screws), run your coax, and you're on the air.

On the Air

I found that this clandestine antenna gives great performance all across the 2 meter band. It is broadbanded enough to use on the packet frequencies at the low end of the band, and it can jump up for FM repeaters at the top of the band. I measured SWR less than 1.6:1 from 144–148 MHz.

The Forbes Group has come up with a very clever solution to what is becoming a bigger and bigger problem in amateur radio. If you live in a restrictive area, or if you are simply trying to keep your rooftop from turning into an antenna farm, the Ventenna could be the antenna solution for you. ■

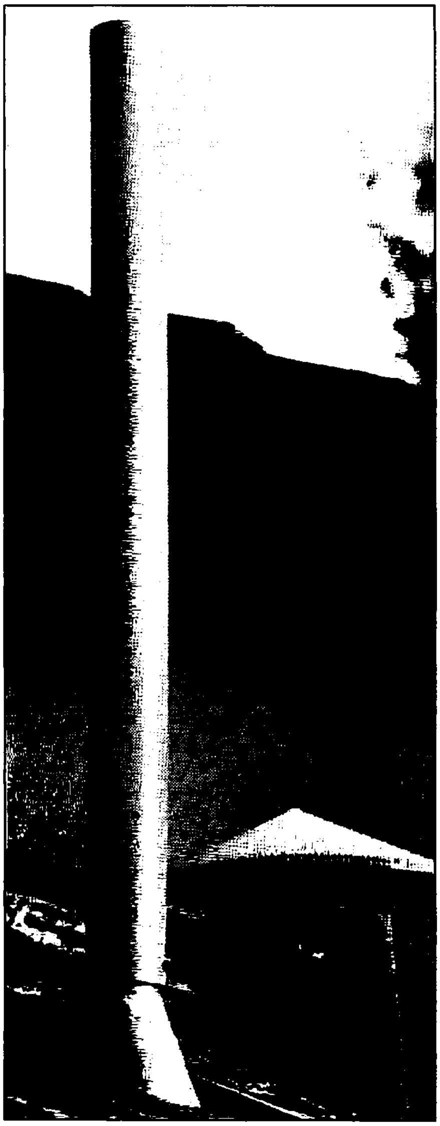


Photo. Vent pipe or antenna? Only the person who put it there knows for sure.

One Desert Storm MARS Experience

MARS readiness and support needed!

by Mike Warner NX7T

In November of 1990 not one community MARS (Military Affiliate Radio System) station existed in the Nuernberg Military Community. The 1st Armored Division's MARS license (Ansbach) was revoked for failure to meet the 40-hour week manning requirement. Only one active amateur club station, the Erlangen, Ferris Barracks Amateur Radio Club, DA2SF, existed in the area. It owed its existence in large part to the German amateur community and the Iron Land Amateur Radio Association (ILARA).

Enter the Gulf War, and of course, the 1st Armored Division's (IAD) deployment. There was a sudden shift of priorities. Second Brigade IAD's new commander, Col. Montgomery Meigs, received a copy of our ILARA newsletter. It indicated our potential and willingness to be a MARS station. This time there was interest.

The newly arrived chaplain of the Division Support Command (DISCOM), Rabbi Ken Leinwand, had started several MARS stations in the past. He also had one amateur among his support battalion commanders.

Dan Pasomoto, whose German call had been expired for two years, joined forces with the rabbi. Dan is the Director of the Learning Centers for the Nuernberg Community, but with all the soldiers leaving for Desert Storm there would be little need for the usual learning center activities. Dan was able to convince the right people to divert money (27,000 DM) from the Learning Center budget to buy amateur radio equipment for the deployment, and to encourage our Community Commander, General Wesley B. Taylor Jr., to request additional equipment from the Amateur Radio Relay League (ARRL).

With letters of commitment from General Taylor and Col. Montgomery Meigs, 5th Signal Command granted two MARS licenses to the Nuernberg Community. One station was established at Monteith Barracks, and the other at the Ferris Barracks Amateur Radio Club Station. A full-time operator was committed to each. By the end of deployment more personnel were added to the Erlangen (AEM1ELN) station, and many volunteers contributed hundreds of man hours to both operations. The ARRL came through with two radios: One TS-140S and one IC-735.

Getting the Equipment

The real difficulty was spending the Learning Center money. Army Contracting was swamped, and suffered drastic loss of personnel at a very inconvenient time. When push came to shove, there was not time to order the equipment from the States. Doing so would have made the available money go much farther, as equipment is generally more expensive in Germany. But there was no time, so it had to be locally purchased.

In Germany, too, when Christmas approaches, most amateur distributors close

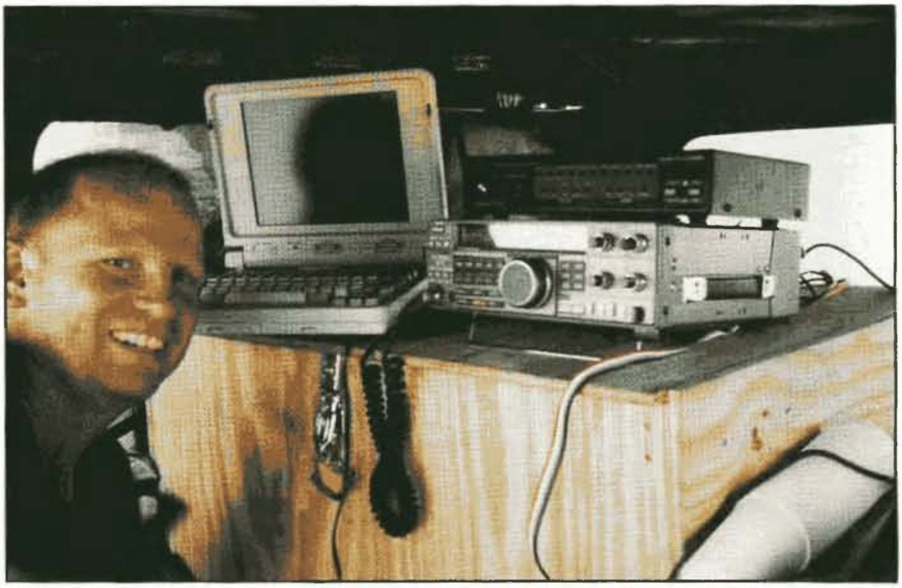


Photo A. SSG Michael R. Warner NX7T, MARS operator during Operation Desert Storm.

Photo B. A well-equipped Desert Storm mobile.

down until the new year. Much of what we needed could not be found at any price, but we managed to obtain six TS-440Ss, a few antennas, and some hardware. Most of the ham/MARS operators spent their own money, some over $500, to help make up shortages.

Two groups from Monteith, the Non-Commissioned Officers Wives and the Officers Wives Clubs, granted an additional $1,500. These funds were added to ILARA club dues to purchase little things like microphones (that don't come with radios when you buy them in Germany), coax cable, insulators, antennas, baluns, a power supply, and other important items like phone patches.

When this equipment was combined with that sent by the ARRL, we were able to equip both the Erlangen and Monteith stations as well as four deployed stations to Saudi Arabia.

Some of the hams in the division deployed with their own personal radios as well. All of us had planned to take our own rigs. Fortunately, it was not necessary for a few of us.

The equipment was purchased just a few days prior to our departure, and we had to work out the distribution. We learned that only licensed hams were to be granted Saudi MARS licenses, and some of the units originally slated to receive equipment had no one with a license. Unit calls were later issued allowing our battalions without licensed hams to have their own MARS call. We did the best we could given the time and information available.

In addition to the two community stations, equipment was divided up among: Chaplain Ken Leinwand, 1AD DISCOM; Headquarters Second Brigade, AEM3XC, SSG Mike Warner (NX7T/DA1YH); 6-3 Air Defense Artillery (ADA), AEM3XK, CW2 Denis Puls (DA1PV); and Alpha Co 94th Field Artillery, AEM3XF, SPC Warren Fitzsimmons (DA2FI). Later 1st of the 35th Armor Battalion, Chaplain Richard Davis (KB2MAX) also obtained his MARS call, AEM3XG, and the IC-735 provided by the ARRL.

AT&T Mops Up

We had the equipment, and troops who wanted desperately to talk to home. In an adjacent sector we heard the 18th Airborne Corps and others phone patching to their loved ones in the States and to Germany. But VII Corps was under restriction. In order to operate we had to go where no troops could find us. But we could and did send message traffic.

For difficult cases commanders would transport their soldiers out to us. Sometimes phone tents were available, and you could call Germany with an AT&T card, but if you didn't have one you were out of luck. If you did have an AT&T card, your wallet was out of luck. Originally, phone calls were costing $27 for 10 minutes. I must ask you to bear in mind that the AT&T equipment at the Saudi end was set up and maintained by soldiers, not AT&T personnel.

Many soldiers will be dealing with their phone bills for months to come. The International Red Cross helped some of these soldiers with grants to help pay the bills. Still, many soldiers' combat pay and their family finances dissolved before their eyes. Some soldiers experienced bills in the order of several thousand dollars. MARS provided a free service. When permitted, we operated, and we were able to do so long before the AT&T system could arrive and long after they shut down. Often AT&T was not there at all.

For whatever reason, in the 7th Corps in general and 1st Armored Division in particular, MARS could not really operate until after the war was over! The reason given was, of course, fear of Sadam DFing us, while at the same time Air Force Liaison (ALO) and 141 Signal operated HF/SSB and teletype (key down for long periods) not only in the area of our troops, but inside our perimeter.

MARSgram Problems

One of the worst and most demoralizing logistical problems at Operation Desert Storm was the mail. Before the war, no one questioned the need to transport bulletins over mail, but nothing changed after the war! Normally MARS is a good alternative to the mail for service members overseas. Since MARS was an afterthought, the plan for delivery of MARSgrams to soldiers in the Gulf was a disaster.

The plan was for all incoming MARSgrams to be dumped in the "Military Postal System, MPS" at Daharan. Many of the messages sent to soldiers were never received. Those that made it through were often received months after being sent. A number of fixes were instituted to allow message dissemination down to unit level through the MARS system if there was a MARS station nearby. But no one really had an accurate list of where the units were, not even the Red Cross! Had there been a MARS station active in each brigade-sized unit, this could have been avoided. By the time the system really started to work, most of the soldiers and families had lost faith in it.

MARS Success, Nonetheless

Still, our MARS operators both in the Gulf and at home saved soldiers in the 7th Corps alone some $250,000 in personal and official communications costs. Had restrictions not been placed on us for operating, and had a plan been in place and working rather than thrown together, I am convinced it could have been four or five times that amount.

Stateside stations like AAR4CSS in Ocala, Florida; AAR5NSF in Minnesota; and AAR2USI at Ft. Monmouth, New Jersey, supported us throughout our deployment. They often operated 24 hours a day using only volunteers from the amateur community. We take our hats off to you! Why none of

Continued on page 59

A Direct-Reading Linear Inductance Meter

Check out your coils with a digital voltmeter.

by Arthur C. Erdman W8VWX

The meter described here allows you to use an inexpensive digital voltmeter (DVM) to directly display inductance in microhenries. The basic principle of operation is that *the width of a pulsed voltage is directly proportional to inductance.* The DVM reads the average (direct, or DC) value. Inductor resistance degrades the linearity (stray capacity has minimal effect), but the circuit constants are such that if measurements are limited to about 250 mV (and 250 μH), the linearity is excellent.

One integrated circuit chip is used for the circuit. One 9-volt transistor radio battery and a 5-volt regulator make up the power supply. A line-powered supply could be used. There are no special construction problems.

The main component is a 14-pin integrated circuit (IC) chip, 74HC132 (the 74HC132 and the RF choke coils are available from Mouser Electronics, 2401 Highway 287 North, Mansfield TX 76063, phone (800) 346-6873). The IC consists of four two-input NAND gates. The IC also has what are called Schmitt inputs. The Schmitt circuits trigger the NAND gates at precise voltage levels.

The complete circuit for the inductance meter is shown in Figure 1. NAND 1 generates the square wave. NAND 2 is an isolation stage. NANDs 3 and 4 produce the desired output pulsed voltage. One input of each NAND is connected to +5 volts. The NANDs operate as inverters. The pulse width is equal to the time it takes the voltage across the unknown inductor to fall from 5 volts to the lower triggering level (about 1.8 volts at room temperature).

Construction

The only construction caution is to try to keep the internal leads to the inductance terminals as short as possible. In my unit, the combined length of the two leads to the terminals is about four inches. I selected 5 μH as a minimum reading. These leads do not cause much unwanted inductance compared with the minimum.

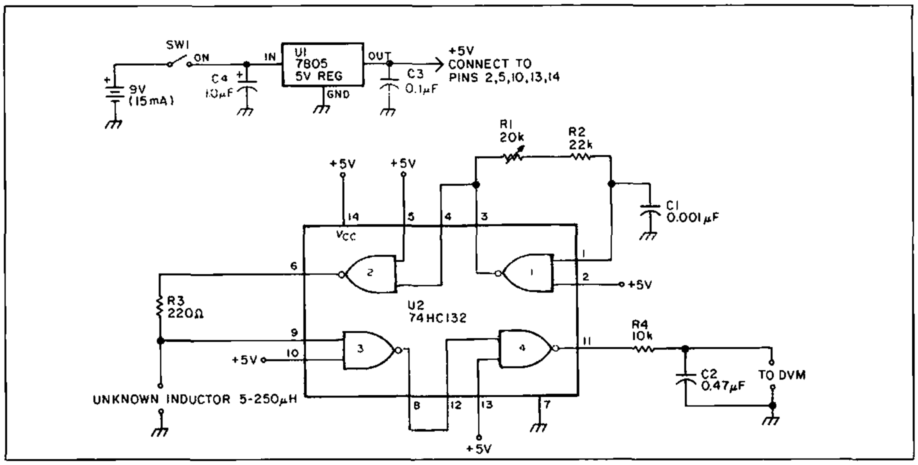


Figure 1. Direct-reading inductance meter.

Calibration

Known-value inductors (5% tolerance) are available from Mouser Electronics for about $1 each.

To calibrate, connect a known-value inductor that has a value close to 250 μH (220 μH inductors are available). If a 220 μH part is used, adjust R1 for an output reading of 220 mV. No other adjustments are needed. If you have other known-value inductors less than full-scale, check the linearity. Don't forget that your inductors have, at best, a 5% tolerance. If you have measured the inductance of an inductor using the inductor in an oscillator circuit, the error in measurement is related to the ratio of fixed external capacitance to the inductor's stray capacitance. The value found by that method is the APPARENT inductance. The value is higher than the true self-inductance. The measuring method used in our unit measures closer to the true self-inductance. (Capacitive effects are minimal.)

This unit will measure inductances from 5 μH to 250 μH. While readings greater than 250 mV are possible, the linearity becomes poor.

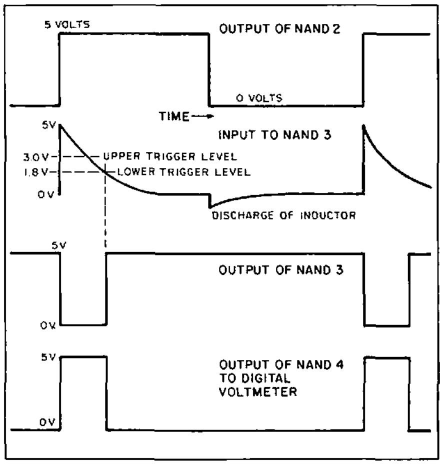


Figure 2. Voltage waveforms for the inductance meter.

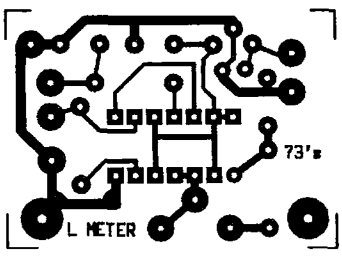


Figure 3. PC board foil pattern.

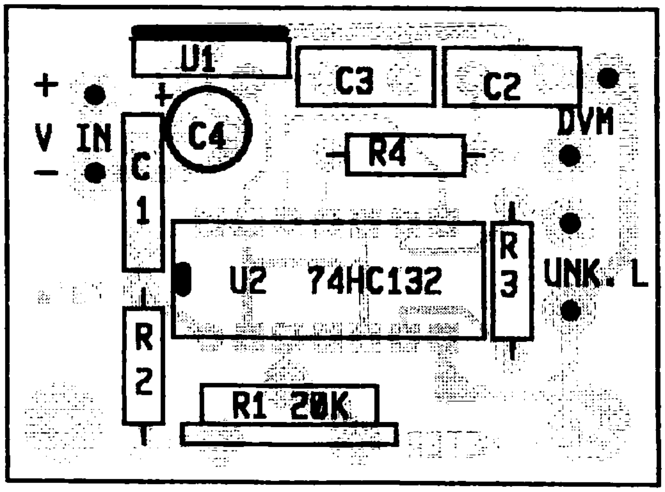


Figure 4. Parts placement.

scope), we found that the effect of stray capacitance is greatly reduced if the resistor, R3, is about 250 ohms. Values of R3 much higher than 250 ohms prevented the inductor voltage from reaching 5 volts due to stray capacitance. As a result, linearity suffered. I used a 220 ohm for R3. If R3 is much lower than 220 ohms, the battery current is too high and linearity becomes poorer due to the longer time constant (L/R). The time constant must be short enough so that the inductor voltage falls to nearly zero every positive half cycle of the square wave. I added an RC filter on the output so that the frequency response of your particular DVM won't matter. (My DVM is a Micronta 22-188 from Radio Shack.) The DVM should have about 1 megohm input impedance.

There are many possible variations in the value of R3 and the frequency of the square wave. However, due to the wide variation in the stray capacitance and DC resistance of inductors in the mH range, linearity is seriously degraded. Consequently, no attempt was made to include readings above 250 µH.

Readers will probably determine that the same circuit, with only a few minor changes, could be used to measure capacitance. True, and I have already built one, but there are so many capacitance meters out there that I decided to drop that feature and reduce the complexity by not adding more adjustment pots and switches.

Parts List

C1	0.001 µF, 16V or higher
C2	0.47 µF
C3	0.1 µF capacitor
C4	1.0 µF/35V tantalum or electrolytic
R1	20k pot
R2	22k
R3	220 ohm ¼W
R4	10k ohm ¼W
R5	22k ohm ¼W
U2	74HC132 integrated circuit
U1	7805 5-volt regulator

A blank PC board is available for \$3 + \$1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Theory of Operation

Figure 2 indicates the waveforms of the voltages present. At the instant the input square wave goes positive (5V), so does the voltage across the inductor. The NAND trigger level is about 3 volts, therefore the NAND 3 output goes LOW (inverter action) while NAND 4 output goes HIGH. When the voltage across the inductor decays to the lower triggering level (1.8V), NAND 3 goes HIGH and NAND 4 goes LOW. In other words, an output pulse is formed. We will be show that the pulse width is directly proportional to inductance.

Examine Equation 1 and Equation 2 to see the linearity, in spite of the fact that the inductor voltage dies exponentially.

Assume no coil resistance. R = external resistance

Equation 1: $V_L = 5e^{-(RT_W)/L} = 1.8V$

T_W is the time it takes the inductor to go from 5 to 1.8 volts. Re-arrange Equation 1 and take the natural log.

Equation 2: $T_W = (L/R)\ LN\ (5/1.8)$

L is in microhenries, R is in ohms, T_W is in microseconds, and LN is the natural log 1.022.

All the terms in Equation 2 are constants. Therefore, the pulse width, T_W, is a linear function of inductance.

The equation for the average (DC) voltage of a rectangular pulse is: (T_P = time of square wave)

Equation 3: $V_{AVG} = (T_W/T_P) \cdot$ height of pulse [5V]

Equation 4: $f(MHz) = 1/T_P$
(T_P in microseconds)

Equation 5: $V_{AVG} = 5 \cdot T_W(f)$
(T_W in microseconds, f in kHz, V_{AVG} in mV)

From Equation 5, if T_W is a linear function of inductance then average voltage is also a linear function. Experimentally (using a

Contact Arthur C. Erdman W8VWX at 224 Chaucer Court, Worthington OH 43085. Please enclose an SASE.

Use Those Surplus Meters

Find out what's inside that meter, and how it can be used.

by J. Frank Brumbaugh KB4ZGC

Junk boxes all over the world hold panel meters with all kinds of scales, most of which provide no clues to the characteristics of the internal movements. If the capabilities of these meters could be determined easily, many would be dusted off and placed in useful service in power supplies and test gear. This article will describe some simple and easy methods that any ham can use to identify the electrical parameters of most types of panel meters, and show how to tailor them to his or her exact requirements.

Meter Varieties

Disregarding the oddball meters which were originally intended for use in military equipment for exotic purposes, most common panel meters are of two basic types: iron-vane and D'Arsonval. Typical of the iron-vane movement are the small, black metal-cased meters such as those manufactured by Shurite and a few other companies. The D'Arsonval movement is a moving coil movement and is used in the more expensive, and accurate, panel meters, as well as in analog VOMs and other types of electronic equipment.

The iron-vane meter is neither very sensitive nor very accurate, and in most cases its function is clearly indicated by the scale on the meter. This meter is often used on automotive battery chargers and in AC line voltage measurement.

The d'Arsonval—moving coil—movement is usually found in meters which at least look expensive, in black or white or clear plastic cases. Occasionally the case may be metal, usually painted black, and a few may be hermetically sealed. Almost every such meter can be identified and placed in service to measure either voltage or current or both (with switching) of practically any value.

Some surplus panel meters, especially those made originally for WWII and more recent military equipment, and many more removed from commercial gear and manufactured under such well-known names as Simpson, Westinghouse, Marion, etc., contain essential information on their faces. For now, ignore the main scale and look at the very small type at the bottom of the meter face, usually on one or both sides of the movement, visible through a cutout in the center. Either the DC resistance, the full-scale DC current, or both may be printed there.

The many small square and edgewise panel meters in plastic cases now available from mail order parts dealers for about $2 are usually 100 μA, 200 μA, 500 μA, or 1 mA movements. However, be aware that these ratings are nominal, not exact, and these inexpensive meters may not have a linear response, regardless of any scale printed on them. These meters are available in left- or right-handed zero and center zero. They were made originally as tuning meters in commercial AM/FM and stereo equipment for home use, and as power and S-meter service in citizen band transceivers.

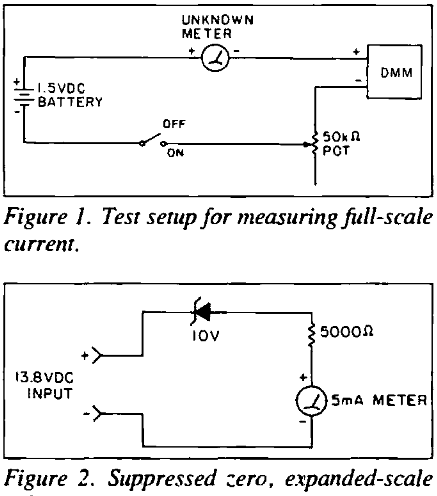


Figure 1. Test setup for measuring full-scale current.

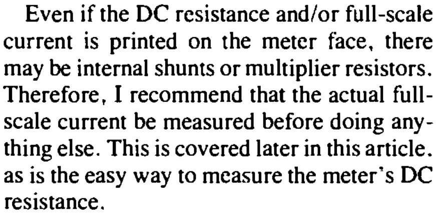


Figure 2. Suppressed zero, expanded-scale voltmeter.

Even if the DC resistance and/or full-scale current is printed on the meter face, there may be internal shunts or multiplier resistors. Therefore, I recommend that the actual full-scale current be measured before doing anything else. This is covered later in this article, as is the easy way to measure the meter's DC resistance.

Meter Disassembly

CAUTION: If you have to make any internal modifications, the meter must be partially disassembled. Use extreme care and the proper tools in taking the meter apart. Equivalent care must also be used in reassembly. Be very careful not to lose any tiny screws! Replacements may be impossible to locate.

Surplus military and commercial meters in black metal or plastic cases are usually held together by three small flathead screws around the circumference of the rear portion of the meter case, near the rear panel. Surplus commercial meters in white or clear plastic cases are usually held together with strips of cellophane tape, but a few may be cemented together with plastic adhesive. Hermetically sealed meters, easily identified by the glass-to-metal seals around the rear terminal studs, cannot be disassembled without destroying them. However, these meters are very accurate, and the printed scale(s) are indicative of their intended use. Use them as-is, or sell them at the next hamfest.

If the meter is held together with screws, use a jeweler's screwdriver of the proper size to remove them, being careful not to distort or burr the screw slots. Put the screws in a safe place so they will not be lost. With one hand, grasp the terminal posts on the rear of the meter and, holding the case firmly in the other hand, gently pull the meter movement from the case.

If the meter is in a plastic case held together with strips of tape, carefully strip the tape off and discard it.

If the meter case has been glued together it *may* be possible to break the seal by carefully cutting through the joints with a sharp knife. This may or may not work, and cutting or prying with a knife may cause the plastic case to crack or break, rendering the meter unusable. However, if you have to disassemble this type of meter, it must have been unusable as-is and thus would not be a great loss. Attempting to take this type of meter apart is not recommended, except as a last resort.

Modifying the Meter

The only internal modification that I suggest for panel meters is the elimination of shunts and series resistances so that the basic meter movement is available at the external terminals.

Shunts will be connected between the positive and negative terminals. Usually they

look like a coil of wire, a resistor, or, in some cases, a piece of printed circuit board. This latter shunt is generally found in very large DC ammeters.

Multiplier resistors may resemble ordinary resistors or small coils of wire. These normally will be connected from the positive meter terminal to an insulated tie-point near the meter coil at the base of the needle. The simplest way to eliminate the effect of the multiplier resistor is to shunt it with a fine wire (AWG 30 or finer), *very carefully* soldering this shorting wire to both ends of the multiplier resistor. If there is room to clip the resistor out, it can be replaced with a short piece of fine wire. Note: In some meters it may be necessary to remove either the meter face or the rear panel to gain access to internal components.

If the meter face must be removed, use a small jeweler's screwdriver of the proper size to extract the two tiny screws holding the meter face to the internal structure. Save these screws, and any small meter needle stops which were attached under the screw heads. Then carefully, without bending the needle, slide the meter face towards the top of the meter and off.

When a new or modified scale is to be placed on the meter to replace the original scale, removing the face first will make this modification easier.

To remove the rear panel of the meter, carefully remove the nuts from both terminal studs passing through the rear of the meter. Save these nuts and any washers or solder lugs that come off with them. Very carefully remove the rear panel from the terminal studs. Note: If you anticipate using shunts or multipliers with the meter, I suggest that you use them externally, *not* placed inside the meter case. Used externally, meter shunts and multipliers can be trimmed or changed at any time if you want to use the meter for a different function.

Meter Reassembly

If the meter face or rear panel has been removed, replace them in the reverse order to that used in removing them. Use the same hardware and tools, and be extremely careful not to bend or break anything. If needle stops were found under the face mounting screws, be sure to replace them in the same positions they had previously occupied.

Meters held together with screws must have the movement inserted into the case so the screw holes match perfectly and the meter face is positioned properly when viewed from the front through the protective glass. **Caution**: Make certain that the slot on the front of the movement slides accurately over the stud on the zero adjust, if the meter is equipped with one.

Before fastening the screws holding the meter together, hold the meter in one hand while adjusting the position of the zero adjust screw on the front of the meter. It *must* be possible to move the needle both above and below scale zero with less than 180 degrees movement of the zero adjust screw.

If the needle cannot be moved as just de-

scribed, remove the movement from the case. Look into the case from the rear and rotate the zero adjust screw to position its stud at the bottom of the case and on the vertical center line. Then, carefully align the slotted extension on the bottom front of the movement into a vertical position so it will slip properly over the zero adjust stud when the meter is again put together.

Slide the movement back into the case, making sure that the screw holes on top of both components match up when the movement is fully seated into the case *without rotating* either component in a way that will affect matching the screw holes.

Check proper seating by again rotating the zero adjust screw so the needle can be moved both above and below the scale zero. Then replace the three screws holding it together and set the needle to scale zero.

Commercial plastic-cased meters seldom have zero adjust capability, and thus are simpler to reassemble. Replace the face if it has been removed, and the rear section, as described above. Finally, use cellophane tape to hold the meter case together.

Many small, square plastic meters don't come with a means of mounting them to a panel. There is sufficient space near the lower corners of these meters to drill small holes from the front panel through the rear of the case to clear 4-40 machine screws. **Caution:** Drilling these holes will leave plastic shavings and chips inside the case. These must be removed to prevent them from lodging in the movement or under the needle and preventing the meter from operating properly. Use great care when removing these chips and shavings so the moving coil and needle are not bent or broken.

Table 1. Copper Wire Table

AWG	Ohms Per Inch
14	0.0002
16	0.0003
18	0.0005
20	0.0008
22	0.0013
24	0.0021

Table 2. Fractions of One Inch

Decimal	Linear
0.0625	1/16
0.1250	1/8
0.1875	3/16
0.2500	1/4
0.3125	5/16
0.3750	3/8
0.4375	7/16
0.5000	1/2
0.5625	9/16
0.6250	5/8
0.6875	11/16
0.7500	3/4
0.8125	13/16
0.8750	7/8
0.9375	15/16

Determining Meter Resistance

Although the methods for measuring the DC resistance of meter movements described in the *ARRL Handbook* and other publications are quite accurate, they are rather complex. The advent of the digital multimeter (DMM) has made such involved methods obsolete. With the DMM on the ohms scale, meter resistance can be safely and accurately measured directly, as simply as measuring an ordinary resistor.

Fortunately, the voltage and current available at the test prods of a DMM set to measure resistance are too low to damage even a 50 μA meter. While most DMMs will pin the needle on a 50 μA movement, the meter will not be damaged. Usually, a 100 μA meter will indicate about three-quarter scale when it is being measured with a DMM. Caution: Use only a DMM to measure meter resistance directly. An analog VOM measuring ohms can provide enough current to destroy a valuable meter.

The range of resistances to be expected will probably be between about 50 and 5,000 ohms. Higher resistances are usually, but not always, found in more sensitive meters. Resistances outside this range suggest internal components such as shunts (very low resistance) or multiplier resistors (high resistance). In these instances, first check the primary scale printed on the meter face. It may indicate the range of current or voltage for which you have an immediate or future use. If this is true, no further action is necessary.

Determining Full-Scale Current

If full-scale current in microamperes or milliamperes is not printed along the lower edge of the meter face, you will have to measure this. Because of the very fine wire used in the moving coil of d'Arsonval meters, basic movement current is limited to about 25 mA, although most surplus meters are usually 1, 5, or 10 mA. This makes these meters more valuable for use as DC voltmeters and ammeters, as well as in ham-oriented equipment of all kinds.

Refer to Figure 1, which illustrates the test setup for measuring the full-scale current of unknown meter movements. Although a DMM is preferred because of its accuracy, an analog VOM can be used for this measurement. Set the meter to indicate DC current, and the 50k ohm potentiometer to maximum resistance. Apply voltage—I suggest using a flashlight battery—and slowly decrease the resistance of the pot until the needle on the unknown meter is at full scale. Read the current on the DMM or VOM. This value is the full scale current required by the unknown meter. Note: Both the DC resistance and full-scale current should be marked on a label attached to the meter. This information will be needed when calculating shunts or multipliers.

Calculating Voltage Drop Years ago it was almost always safe to assume that any basic meter movement of the d'Arsonval type was a "50 millivolt movement." No longer.

To discover the amount of DC voltage required to produce a full-scale indication on the meter, you'll have to make a very simple Ohm's law calculation. The full-scale current and DC resistance have already been measured so you can determine the voltage drop by the formula: $E = IR$, where E = volts across the meter; I = full-scale current in amperes; and R = DC resistance in ohms. This value should be marked on each meter. It will be required in making shunts to allow greater current to be measured.

Voltage Multiplier Resistance

A DC current meter in series with a resistor becomes a voltmeter and the scale is calibrated in volts. It is necessary to know the full-scale current of the meter in order to choose the proper series resistance. Because the voltage drop across the basic meter movement is only a few millivolts, it can be ignored and the value of the multiplier resistor determined from the full-scale current required by the meter and the maximum voltage required to be measured. Again, a simple Ohm's law calculation will tell you what you need to know: $R = E/I$, where R = multiplier resistor in ohms; E = maximum voltage to be measured in volts; and I = full-scale current of the meter in amperes.

A special application is a *suppressed zero, expanded scale voltmeter*. This allows spreading a narrow voltage range over the entire meter scale, a voltage range which is referenced to a point above ground. For instance, you might want to monitor the +13.8 VDC from a regulated power supply which powers a modern transceiver. If an ordinary voltmeter, which measured from zero to, perhaps, +15 VDC were used, any voltage variation around the +13.8 volt point would hardly be visible on the normal panel meter. An expanded scale voltmeter, which would measure only the 5 volt spread between 10 and 15 volts, would enable even small variations of the +13.8 VDC to be seen.

The properties of zener diodes, available from a few to a few hundred volts, form the magic ingredient which allows such a narrow voltage range to be easily monitored. The zener diode establishes the voltage equivalent to scale zero on a low voltage meter, and the meter will not indicate a voltage lower than the conducting point of the zener diode chosen in each application.

Figure 2 illustrates a typical suppressed zero, expanded scale voltmeter which monitors only the range between +10 and +15 VDC. The values given are for a 5 mA meter and uses a 10 volt zener diode to establish the voltage at which the meter (which, with its multiplier resistance, becomes a 5 volt meter) starts to conduct. This example illustrates the simplicity of the application and you can adjust for just about any voltage monitoring application that most hams might need. **Caution**: Be sure to consider both the current-carrying capacity and power dissipation maximum of the zener diode used in any application where this type of voltmeter is to be used. If the zener diode should develop a short, it is likely that the meter movement would be damaged and the needle "wrapped around the pin."

Current Shunts

A DC current meter shunted by a small resistance becomes an ammeter capable of indicating greater current than the basic meter movement. The new scale is calibrated in amperes or milliamperes, depending on the application. A shunt to allow the meter to measure higher current is very simple both to calculate and to make from common copper wire. The voltage drop across the meter, the maximum current to be measured, and good old Ohm's law again are all that are required to calculate shunt resistance: $R = E/I$, where R = reputed shunt resistance in ohms; E = voltage drop across the meter, in volts; and I = maximum current measured in amperes.

Table 1 gives the value of ohms per inch of copper wire sizes from AWG 14 through AWG 24. These values have been rounded off to four decimal places. These values are very small so I suggest using a calculator to determine the length of wire in the shunt.

To determine the length of copper wire needed for the shunt, choose a wire gauge that seems reasonable for the maximum current to be measured. As a guide, remember that AWG 22 is suitable for 5 or 6 amperes, and AWG 16 is sufficient for 20 or 25 amperes. Smaller wires (higher AWG numbers) may be used for lower current values, and vice versa. Larger wire sizes make shunts self-supporting. Smaller wire sizes for shunts should be wound on forms such as 1 watt resistors.

Calculate the shunt as follows: $L = RS/RW$, where L = length of wire in inches and decimal fractions; RS = required shunt resistance in ohms; and RW = resistance of one inch of chosen gauge wire (from Table 1). The required length of shunt wire will seldom be in an exact number of inches. Use Table 2 to convert decimals to fractional equivalents.

As an example, assume that the meter movement has a voltage drop of 50 mV at full scale and that 20 amperes is the maximum current to be measured, the current equivalent to full-scale on the meter. In this case, AWG 16 wire will be used to make the shunt. Therefore: $L = 0.0025/0.0003$, so L = 8.3333 inches (8-1/3 inches).

Referring to Table 2, 0.3333 inches is closer to 5/16 than 3/8, so this is added to the eight inches, giving a total length of wire of 8-5/16 inch for the 20 ampere shunt.

Now all those meters gathering dust in junk boxes can be easily revived and given a purpose in life. Don't let them hide in dark corners. Clean them up, check them out, and put them to work in the ham shack. And, be sure to bypass the terminals of each meter with a 0.01 µF disk capacitor to prevent stray RF from causing erroneous meter indications.

Contact J. Frank Brumbaugh KB4ZGC at 1812 Marilyn Ave., Bradenton FL 34207-4743. Please include an SASE.

Number 14 on your Feedback card

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Staten Island NY 10313-0006

Moonbase America

At the Dayton Hamvention, I was privileged to have then-10th-grader Lenny Mack KB8KTC speak at my Youth Forum about his participation in the famous Moonbase America project. Lenny was the command controller in charge of the entire project from his school. He spoke enthusiastically to the youngsters and adult hams in attendance at the forum.

In recognition of 1992 as the International Year of Space, Moonbase America provided students across the country with an opportunity to participate in a national educational project. Different schools had varied levels of involvement, but all the schools that participated benefited from the unique perspective on learning.

Photo A. Aerial shot above Moonbase America.

In April 1991, 84 students from the Copley-Fairlawn Middle and High School participated in a week-long simulation of a moon base. During this time, 17 Copley-Fairlawn students manned the Command Center outside of the structure. The students lived in a self-enclosed city consisting of nine geodesic domes and conducted all aspects of survival on the moon. Students from 15 local schools assisted. The project incorporated many fields of study: science, computers, electronics, math, English, history, government, restaurant management, business, physical education, communication, technology, music, library sciences, and foreign languages.

Moonbase America was developed to encourage students to actively participate in their own education. Students were asked to project themselves into the future to discover the technology and environment they need. The project was networked throughout the United States. Eighteen schools were chosen as major participants, dedicated to one critical area of the program: hydroponics, fish hatchery technology, robotics, space science experiments, and space science medicine.

These satellite schools reported directly to Moonbase America with their experimental results and solutions to planned and unplanned problems. The scope of participation was unlimited because all other interested schools followed a general coinciding curriculum and were offered the opportunity to participate in national PBS satellite broadcasts aired during the occupancy of the Moonbase.

The national curriculum was developed through the support of nationally recognized high school and college instructors. This project gave students experiences which are not available in the normal classroom setting—interacting with their peers in other states, discovering the importance of sharing ideas, designing their own courses of action, and working closely with professionals from the business community.

Through the assistance of NASA, corporate sponsors, civic organization, and national student and teacher participants, Moonbase accomplished its goal: students permanently interested in becoming involved in the sciences, space, and learning. Lenny was kind enough to forward the following write-up to me. For further information, Lenny can be contacted at 3400 Ledgewicke Circle Fairlawn OH 44333, or KB8KTC @ WB8BII . OH.USA.NA

KB8KTC: Ham Radio Highlighted

"Houston, Tranquillity Base here, the Eagle has landed." These were the first words transmitted from the moon by Neil Armstrong on July 20, 1969. Billions of people back on earth watched the ghostly images of Armstrong take the first steps on the dusty lunar surface. Yet, by the end of 1972, the Apollo program had been terminated and no one has set foot on the moon again—until last April when 84 students from Copley, Ohio, spent one week on the lunar surface in a Moonbase. Well, not really, but we came just about as close as you can and still stay on our own planet.

The simulation Moonbase America enabled 84 students to live in a moon city for seven days. The city, consisting of a geodesic structure of nine domes, included everything needed for survival: a fish hatchery, food preparation, government, communications, and waste management, with specialists in all areas. Each student spent an entire year in a space science class, a state accredited science course, and many after school and weekend hours training for their positions for the simulation.

Our training in ham radio began early in the school year. Members of the Cuyahoga Falls Amateur Radio Club donated several hours of their time during the day to come in and teach the 84 students the fundamentals of ham radio and prepare them for the Novice code and theory tests. Sixty of the 84 students passed their tests and obtained the Novice license for use during the simulation. Some students opted to upgrade to Technician for further privileges.

Once the simulation began, amateur radio played a major role in its success. Some events involving amateur radio could have been lifesaving if we had really been on the moon.

Located inside the 50-foot dome were: a communications console consisting of a full HF station for special event operation; two dual-band 144/440 MHz base station radios for communication to ground crews; one 220 MHz base station radio for internal communications, one 1.2 GHz base station radio for communications to the ground; an ATV transceiver for video link to ground; a VHF packet station; a complete satellite tracking system, including a 386 computer running satellite tracking software; a satellite 144/440 MHz all-mode transceiver; and 10 220 MHz hand-held radios located throughout the base for internal communications.

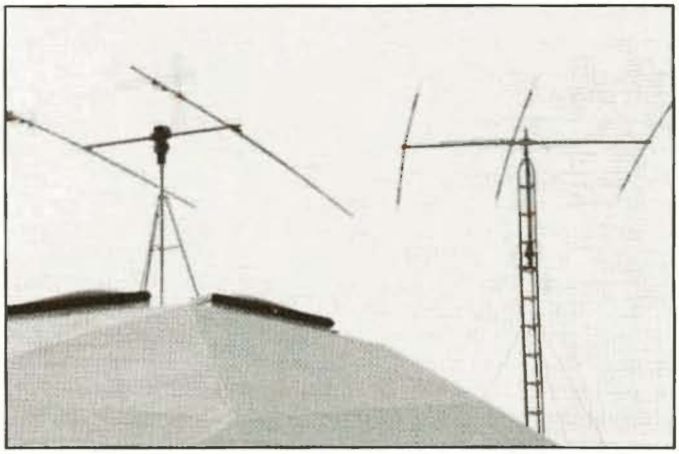


Photo B. Satellite tracking antennas (on the left) on top of the main dome of Moonbase. To the right is a 3-element triband HF beam on a 40-foot tower.

At the command center on the ground, there was a similarly equipped station. Also, for external moonwalks, there was an ATV transmitter located on the Moonrover for live video. This entire system enabled us to keep in contact with the command center back on ground (located in the high school

Photo C. Lenny Mack KB8KTC, sitting at the communications console, is operating the special event station.

auditorium), throughout the domes, and with moonwalkers during their walks.

Some might ask, "Why amateur radio in a moonbase?" Amateur radio, as most hams know, is a reliable source of wireless communications for video, voice, computer, and other modes. One evening during the simulation, the electricity failed, and all other means of communications with it. But our 220 MHz battery powered handhelds provided a link to the ground.

Each day two students exited Moonbase for the daily moonwalks with hand-held radios and VOX headsets for communications to each other, the ground crew, and people inside Moonbase. In everyday activities, we used ham radio for internal communication between pods. Specialists in each area used the radios to keep in contact with other people throughout the base. We also used it as entertainment, talking third party to friends and relatives back on the ground.

Moonbase was a milestone in education here in the United States. It not only taught the students at Copley High many things on topics such as government, space, environment, computers, living together in a closed area with 83 other people for a week, and many other things too lengthy to list, but it also taught teachers and students abroad that education can be fun, hands-on, and rewarding for the student and teacher.

I would like to extend a special thanks to ICOM of America for the donations of equipment used during the simulation, the Cuyahoga Falls Amateur Radio Club for technical support before and during the project, with special thanks to Mike Young WB8CXO and Rich Burgan WC8J, without whom none of this would have been possible.

Please send write-ups on interesting classes, recruiting ideas, youth club activities, or individual children's experiences, along with photos, to Carole Perry at the above address.

HOMING IN

Radio Direction Finding

Joe Moell, P.E., K0OV
P O. Box 2508
Fullerton CA 92633

Up, Up, and Away

For the past three years, I have encouraged you to send me news of your local radio direction finding (RDF) competitions (often called foxhunts or T-hunts). Some have, but most of you are apparently too busy hunting and building to write. Luckily, I've had the chance to visit some of you and take photos. This month, "Homing In" goes T-hunting in New Mexico.

Albuquerque is probably best known for its annual Balloon Fiesta. It's hard to describe adequately: hundreds of hot air balloons in the air, all shapes and sizes, all immensely colorful. Where they will land is quite unpredictable, so each balloon's pilot needs to communicate with its chase crew.

Balloonists and crews use every possible radio service, from business band and cell-phone (legal) to marine band (illegal) and ham radio (illegal when unlicensed or commercial). The Fiesta is a scanner owner's dream and an FCC field engineer's nightmare. April and I didn't see the feds there, but there were plenty of rumors.

The morning balloon ascension was just a prelude to the afternoon's fun—an Albuquerque-style T-hunt. There is a hunt almost every Sunday afternoon on 146.565 MHz, starting from the University of New Mexico campus. Typical boundaries are determined by the Albuquerque AAA city map. To win the hunt, you must have the lowest elapsed mileage. Occasionally, time determines the winner instead.

High-Tech RDF in 5-Land

Competitive hunting is new to most Albuquerque hams, so they aren't set in their ways. They are eager to try out various RDF methods, and they don't fear failure. Some have already put a big hole in the car roof for a 2 meter quad (Photo A), or arranged another semi-permanent mounting method for a rotating gain antenna (Photo B).

Most use some sort of compass rose at the bottom of the mast to indicate direction. Jerry Boyd WB8WFK has gone a step further. He mounted a precision linear 360-degree potentiometer to the bottom of his mast (Photo C), and connected it to a meter readout atop the dash. Now he can see which way the beam is pointing without looking down.

There are endless possibilities for enhancements to this scheme. The direction indicator could be directly tied into a laptop computer for real-time triangulation. (Substituting a sine-cosine pot would probably simplify the software design.)

Correction for vehicle heading to give true (relative to north) bearings could be done by adding the output of a vehicle-mounted flux-gate compass. Who will be the first to do all this, and put the readout into a "heads-up" display? I'm waiting for your photos.

The terrain within the Albuquerque hunt area is fairly level, although there are mountains outside the boundaries that can provide some interesting signal reflections. To add an extra challenge, most hiders put their fox transmitters well away from driveable surfaces, forcing hunters to get out of their vehicles and scout around as they close in.

Fox hunters do this electronic on-foot "sniffing" with a variety of techniques, ranging from "body fades" with hand-held radios, to field-strength meters on their beams, to special homing RDF units (Photo D). The W9DUU design, which uses time-difference-of-arrival (TDOA) technology, has been well received in Albuquerque. (W9DUU's RDF unit is described in *73 Amateur Radio Today*, July 1990, page 9. More information on commercial and home-brew TDOA sniffers can be found in "Homing In" for September 1989 and November 1989, and in *Transmitter Hunting—Radio Direction Finding Simplified*, a 323-page book by K0OV and WB6UZZ, published by Tab Books, and available from Uncle Wayne's Bookstore.)

These hunters have come a long way in a short time, and are still thinking big. At the post-hunt barbecue, a (nameless for now) hunter took me aside to covertly show off a new "secret weapon" antenna system he was working on. It was temporarily hidden in the back of his vehicle. I hope he has revealed it and given it a couple of battle tests by now.

Albuquerque T-hunts have garnered some nice publicity. They were featured on a local TV news report recently. My thanks to the T-hunters of Albuquerque for a great hunt experience. The barbecue, hosted by Kevin N6QAB and Susan Kelly, was equally fun.

Support Your Local Sheriff

Evening Shade is not just the creation of a whimsical TV writer. The name comes from a real-life town of 450 souls in northeast Arkansas, at the eastern end of the Ozark Mountains. (Actually, there are two Evening Shades in the state, but that's another story.) The hams of Evening Shade and vicinity aren't regular T-hunters (yet), but they knew enough about RDF

Photo C. Mount a precision 360-degree or sine-cosine potentiometer to the bottom of your antenna mast, and you can have remote indication of your mobile beam heading. Jerry Boyd WB8WFK installed his mast to the driver-side door.

to perform a valuable public service last September.

Monty Haley WJ5W, who broke the story, lives in Evening Shade. It all started when a strong unmodulated carrier appeared on the sheriff's 150 MHz repeater in nearby Walnut Ridge, jamming all other signals. Walnut Ridge, the county seat for Lawrence

Photo A. Bob Lindsey KF5W had little hesitation about taking a big punch to the roof of the family car He uses a commercially available quad for his 2 meter hunting.

Photo B. Joe Riggs WA0TWG mounted a beam and mast to the driver's side of his pickup. Left-side overhang restrictions in your state's vehicle code may limit your antenna size using this method.

Photo D. Most Albuquerque T-hunts require an on-foot "sniff" at the end. WB8WFK says his W9DUU-design homer works great.

County, is about 35 miles east of Evening Shade.

The QRM started early Thursday morning. Communication was quite difficult for the sheriff without the repeater. "They were forced to use one of the simplex frequencies that the city of Walnut Ridge had for police use and was programmed into all the county cars," said WJ5W. "It worked, but there were a lot of dead spots."

Authorities believed the interference was malicious, and suspected a local ham. "He wants to become a police officer and has a car with lots of antennas like a police car. He told us on 2 meters that the sheriff was blaming him for this, that they were calling in the FCC from New Orleans to be there Monday morning, and that he was ordered to be at the sheriff's office when the FCC came there. As soon as I heard that, I said, 'We're going to find this,' " Monty reported.

Using extended frequency coverage on his 2 meter rig, WJ5W could hear the carrier on the sheriff's repeater input at his location. He put out a general packet message and called some hams on the phone and local repeaters to see if they could get base station beam bearings.

"It took a couple of hours to do all this," he said. "Once we got the beam headings and figured out the general area, three of us took off in our cars. It was six o'clock Saturday when we decided to do something about it, and it was just after ten that night when we found the problem."

The sheriff's personnel had checked all their own radios, but other agencies have equipment with the sheriff's repeater frequencies. "I'm a volunteer firefighter," WJ5W related. "So I'm pretty familiar with fire departments in the area and I knew that a fire radio was a likely cause of the problem. I thought it might be the mike on the seat of a fire truck keyed up.

"That was the reason I was looking for a fire station in the area. There were three of us. We were driving in the general direction—one from the west, one from the south (me) and one from the east, all going to where the beam headings converged and talking to each other on 2 meters."

Sure enough, a failed radio relay unit at the fire station in the town of Strawberry was the culprit. Monty was proud that hams' efforts resulted in some favorable PR: "The sheriff put something in the local paper thanking all the hams who had helped. The guy that they suspected earlier was prominently mentioned as being one who helped find the problem."

"In some states what we did would have been illegal due to restrictive scanner and mobile receiver laws," WJ5W pointed out. "I think If something like this happened again, they would contact us early on. Now that they know we can do it, and we know we can do it, they should be a lot more apt to get us involved from the beginning."

Congratulations to Monty and to the other participants: Larry Allen KB5ECV, Carl Duckworth KB5TI, Nelson Bailey K5TML, and Kenneth Thompson KG5KS. Are you prepared to use your RDF skills to assist agencies in your area?

Number 16 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
%73 Magazine
Forest Rd.
Hancock NH 03449

Flavors of Amplifiers

Continuing our discussion of gain (my, there's a lot to tell, isn't there?), we turn now to the various types of amplifiers. It might seem intuitive that an amplifier is an amplifier is an amplifier, but it just ain't so. There are many types, called "classes," of amplifiers and each has its own characteristics. Consequently, each also has unique advantages and drawbacks. Let's look at the various applications and which kinds of amps are best suited to them.

Know Your Limits

Oops, perhaps I spoke a bit too soon. Before we can do that, we must have a basic understanding of the limits of an amplifying device. These are simple: The amplifier cannot produce an output voltage lower than its lower power supply voltage (usually ground or zero volts), and the amp cannot produce a voltage higher than the voltage of the power supply system feeding it. Note that I say power supply "system" because the inductive tank circuit of a tuned amplifier can be considered part of the power supply (because it stores power), and in such an amplifier a voltage higher than the DC voltage feeding the amp can appear at its output. In essence, the tank inductance is acting like an autotransformer, converting power supply current into a higher voltage just like any step-up transformer.

Any attempt to drive an amplifier past its limits will result in "clipping," in which the output will stay at its limits as the input continues past them. If you've ever seen it on a scope, you know where the name comes from, and if you've turned your stereo up to the distortion point, you know how ugly it sounds. By the way, in transmitters we call it "flattopping," but it's the same thing: The amp just can't go any further, so the tops and bottoms of the waveform are clipped off.

Speak Into the Linear, Sonny

Audio is linear in nature. That is, it is represented by a changing voltage whose changes correspond to the fluctuations in sound pressure. Thus, what comes out of an audio amp must be a replica of what goes in. Any change in the signal will cause an untrue sound, and that is by definition distortion. Actually, there is one exception: The signal may be completely inverted without being damaged; such inversion is not readily detectable by ear, and re-inversion is easy to accomplish anyway, as no information has been lost.

I'd Give it an "A"

There are several types of linear amplifiers. The simplest, and perhaps the "cleanest," is the type A. This design biases the active amplifying element (the tube or transistor) in the middle of its linear region. In other words, the element's resting voltage is set halfway between the points of complete saturation and complete cutoff. This biasing arrangement permits the incoming audio signal to swing up and down (audio is an AC phenomenon) without forcing the amplifier out of its linear region. The amp's output will be a replica (or inverted replica, depending on the design) of the input signal, only bigger. Naturally, if the input signal gets too big, the output will slam into its limits and the amp will clip.

This works great, so why not use it for everything? Well, it has some disadvantages. First, the output is not true AC because it is not centered around zero volts. Rather, it is centered around the bias point, so it never changes polarity with respect to ground. To restore the true AC nature of the input signal, it is necessary to pass the amp's output through a capacitor or a transformer to block the DC component of the wave. That works fine but it, too, has drawbacks, including distortion and frequency-dependent actions.

Actually, there's a far greater problem with class A amplification. Because the amp is biased midway, it is always dissipating current. In fact, at any moment, it is burning half the total supply current! As the audio signal bounces up and down, the current demand follows it, but it all averages out to the same amount as the resting current, which is at the halfway point. Wow, that's a lot of heat! Not to mention the waste of power. Still, a class A amp has the lowest distortion of any type, and some ultra-hi-fi audio systems still use the design despite its serious drawbacks. Such amplifiers will have very large heat sinks for their power transistors and will have hefty power supplies as well.

B Is For Better

Although the class A amplifier reigned supreme for many years, designers were always looking for a better, more efficient way. It was reasoned that if the bias point were set to zero, then the amp would draw no resting current and would run cool. True, but it would also cut off the bottom of the input waveform (which would now be below the amp's cutoff point), turning the amplifier into a rectifier. Now that's what I call distortion! But wait a minute, what if there were another amplifier of opposite polarity hanging under the first one, so that each amp worked on one half of the input signal while the other one loafed? Son of a gun, it works. Two amplifiers connected in this way are called a class B, complementary or push-pull, amplifier. (There's a variation on this called a quasi-complementary, but the arrangement is basically the same.)

This technique has lots of advantages. It draws no resting current, so it runs much cooler than a class A and does not need as big a power supply. Also, its output is truly bipolar, so it needs no capacitor or transformer. Of course, a bipolar power supply is required for this amp.

Class B amplifiers seem perfect, don't they? Well, they would be if the amplifying elements themselves were flawless. Alas, they are not. In particular, the elements begin to exhibit nonlinearity when they are very near their cutoff and saturation points. In other words, the amount of gain changes with the signal level, causing distortion. And, unlike the class A design, which keeps the signal safely away from the cutoff point, the class B hits it each time the input signal changes polarity and shifts to the other half of the amp. The result is called crossover distortion, and it has a particularly nasty sound.

This is one area where tubes beat transistors hands down. The nonlinearity in tubes is very small, permitting class B designs to sound reasonably good. Semiconductors, on the other hand, have such poor linearity near their cutoff points that transistor class B amps are just plain horrible. In fact, this problem was the reason hi-fi purists rejected transistors in the early days. Some still do.

When Is a "B" Not a "B"?

Fortunately, there's an easy way out. If we bias each half of a class B amplifier so that it is turned on *just a little*, we can keep it away from the ugly cutoff points and the signal will remain clean. Of course, the amp will draw some resting current, but far less than would a class A, because the bias point is so low. This is called a class AB amplifier, and it is the design used in most hi-fi audio amps today.

But We're Hams

So why am I going on and on about audio amps anyway? After all, we're hams, not audio purists, right? Well, these same designs are used in RF power amps too. In fact, there's another type, the class C, employed as well. Let's look at the requirements of RF amps and how they are filled by the different types.

In radio, the type of amp chosen depends upon the signal you are trying to amplify. Yes, you could simply go with a class A or AB and call it a day. But there are drawbacks. The class A is very inefficient and wastes power. And a class AB is tricky to accomplish at very high frequencies because small differences in capacitance between the two halves can cause mistracking and distortion. Ultimately, the design used will be matched to the modulation method of the radio signal.

FM and CW

In FM, the power output is constant and the frequency of the carrier wiggles back and forth a little, in step with the modulating signal's amplitude. We all know that what goes out the antenna must be a nice, clean sine wave, but it sure doesn't have to start out that way! Because the amplitude of the carrier doesn't change, we don't have to worry about linearity at all! We can make an ugly, distorted pulse and filter it into a sine wave (by filtering out all of its harmonics) after amplification. Remember what I said would happen if you biased a class A at the cutoff point? It would amplify one half of the signal and cut the other half off like a rectifier. Well, if you don't care about that, you can make an extremely efficient, simple amplifier. If you feed it sine waves, the result will be half waves. If you drive it all the way to saturation, the output will be clipped into pulses. The amplifier will also be running about as efficiently as any could, because it will spend most of its time all the way on or all the way off, and it's the "in betweens" that waste power. Such an amplifier is called a class C, and it's the kind you will find in your walkie or mobile FM rig. It's also great for CW which, like FM, has no amplitude changes within the carrier. The output filter cleans the mess up and sends nice, shiny sine waves to the antenna.

AM

There are two ways to make AM. One is to modulate the carrier at a low level and then amplify it later. This technique, common in multimode rigs, requires a true linear amplifier because any significant distortion will ruin the modulation's amplitude changes. But there's another way. You can make pulses and amplify them via class C, the same way as in an FM rig. Then, by feeding the class C stage with DC power modulated by the audio (instead of pure DC power), you can make its output follow the modulation, creating AM. This is called high-level amplitude modulation. In the tube days, it was known as plate modulation. Most AM-only rigs, such as CBs and older transmitters, use this technique precisely because it avoids the need for linear amplification, which is much harder to do.

SSB

Single sideband is a special form of AM. But, because of the need to filter out the carrier and one sideband, it is not practical to generate SSB via high-level modulation. (If you did, you'd be generating and then discarding large amounts of power.) Thus, virtually all SSB rigs use low-level modulation and linear amplification. The amp may be class A or AB. Naturally, it won't be as efficient as a class C, but that is made up for by the nature of SSB: Large amounts of power are drawn only during voice peaks, since there's no carrier. On average, an SSB transmitter with a class AB amp is the most efficient for voice service.

Well, we're out of space. See you next month! Write to me at the above address with your questions on trouble-shooting. 73

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

JAN 11

MILWAUKEE, WI The West Allis RAC will hold their 20th annual Midwinter Swapfest at the Waukesha Co. Expo Center Forum from 8AM-2 PM. Directions: I-94 to Co. J, south to FT, west to Expo. Admission $3 in advance, $4 at the door. Table space: First 4 ft. $3 in advance, $4 at the door; additional 4 ft. $4 in advance, $5 at the door; electrical outlet $5, as available. Advance reservation deadline Dec. 31, 1991. Amateur exams given at Red Carpet Lanes across the street, starting at 9 AM. For tickets or info, write with SASE to ***WARAC Swapfest, PO Box 1072, Milwaukee WI 53201.***

JAN 18

MONTEREY, CA All persons are invited to participate in the free public service event, Winterfest 1992, which will be sponsored by the Naval Postgraduate School ARC at Monterey Peninsula College Armory, rain or shine. There will be an indoor Flea Market and an outdoor Tailgate Market, as well as commercial vendors. Demonstrations include Voice and CW, ATV, Slow Scan TV, Computers, Satellite, Packet, MARS and ARES. Contact ***Pat KA6IRS at (408) 649-4444, Ext. 20, days***, or ***Doug KC3RL at (408) 863-6117, eves.***

JAN 19

YONKERS, NY Metro 70cm Networks will sponsor a Giant Electronic Fleamarket at the Lincoln High School on Kneeland Ave., from 9 AM-3 PM, rain or shine. Free parking. No tailgating. Indoor Flea Market. VE Exams 10 AM-2 PM. Free frequency check. Sellers: $15 1st table, $10 each additional table. All tables 30" x 5' or bring your own table at $1.80 per ft. minimum. $10 full payment is due with registration. At the door, $20 all tables, and $2.50 per ft. No paid reservations will be held past 9 AM. No refunds unless notification of cancellation has been received 72 hours in advance of the event. Admission $4, kids under 12 free. Set-up at 7 AM. Register with ***Otto Supliski WB3SLQ, (914) 969-1053.***

JAN 25

CRYSTAL RIVER, FL The 12th annual Citrus County Hamfest, sponsored by Sky High ARC, will be held at the New National Guard Armory on Seven Rivers Dr., just off US19 south of Crystal River Airport. Admission $4 before Dec. 20th, $5 thereafter. Indoor tables $10, (wall tables $12). Outdoor Fleamarket spaces $6. ALL exhibitors and helpers MUST purchase admission tickets. Talk-in on 146.355/.955. Call ***Ed Gaudet K4BRC, (904) 748-2371***, or write ***SHARC Hamfest, 9 S. Davis St., Beverly Hills FL 32865.***

GALLATIN, TN The Tenn Valley AR Network, Gallatin Section, will hold its 2nd annual Winter HamFestival in the National Guard Armory on Highway 25 east of Gallatin, from 7 AM-3 PM. Set-up Fri. from 12 noon-5 PM; 5:30 AM-7 AM Sat. Register for VE Exams at 8 AM, take the test at 10 AM. Tables $5. Admission $4. Talk-in on 147.30+, 443.300+, 145.31 repeaters. Buy, sell, trade. New and used gear. Contact ***Bill Ferrell N4SSB, 1120 Douglas Bd. Rd., Gallatin TN 37068. (815) 452-3962 after 5 pm.***

JAN 26

VILLA PARK, IL Wheaton Hamfest 92, sponsored by Wheaton Community Radio Amateurs, will be held at the Odeum Expo Center from 8 AM-3 PM. Tickets $5 in advance with 2 drawing stubs; $6 at the door with 1 stub. All tables reserved—free for clubs (no selling at club promo tables). Info: ***(708) 629-8006***; Flea Market ***(708) 231-2423***; Commercial vendors ***(708) 629-8889*** or FAX ***(708) 629-7098.***

MILFORD, CT The Coastline ARA, will hold VE Exams at 12 noon at the Fowler Bldg., 145 Bridgport Ave., Milford CT. All classes. Contact ***Gary NB1M, 933-5125, West Haven*** or ***Dick WA1YQE, 874-1014, Milford.*** Walk-ins welcome.

SOUTHFIELD, MI The Southfield High School ARC will sponsor their 26th annual Hamfest/Electronics/Computer Swap & Shop at the Southfield High School, 24675 Lahser, from 8 AM-3 PM. Set-up at 6 AM. Admission $4, children 12 and under free. Reserved tables $13 for each 8 foot table. Paid admission required. All profits from the Swap & Shop go toward Electronic Scholarships and to support the activities of Southfield High School's ARC. Make checks out to Southfield High School: ***Robert Younker, Southfield Senior High School, 24675 Lahser Rd., Southfield MI 48034.*** For info call ***(313) 746-8675*** or ***(313) 746-8658.***

JAN 28-30

SAN JOSE, CA The Windows&OS/2 Conference will be held at the San Jose Convention Center Jan. 28 thru 30. Tutorials will be on Jan. 27. Over 250 leading software and hardware vendors will be exhibiting their products. Contact ***Stan Politi, Show Director, CM Ventures, Inc., 5720 Hollis St., Emeryville CA 94808. (510) 601-5000.***

SPECIAL EVENT STATIONS

JAN 5

DAVENPORT, IA The Davenport RAC will sponsor the 1992 Zero District QSO Party from 1600Z-2400Z on these suggested frequencies: CW-60 kHz up from the low band edge; Phone-3.900, 7.270, 14.300, 21.350, 28.360; VHF-146.52 (no repeater QSO's); Packet-145.01. Certificates will be awarded. Mail logs by Mar. 1 to ***/W0BXR, Zero District QSO Party, 2131 Myrtle St., Davenport IA 52804.***

JAN 11-12

KIMBERLING CITY, MO The Kimberling ARC will operate Station NQ0G 1400-2000 on Jan. 11 and 12, in conjunction with the Festival of Lights of The Ozarks. Operation will be in phone 30 kHz up from the bottom of the General portions of the 15, 20 and 40 meter bands, 28.330 and in CW 30 kHz up from the bottom of the bands, plus Novice portions of the 15, 20 and 40 meter bands. For certificate, send SASE to ***The Mayor, Kimberling City MO 65686.***

JAN 28

SAN DIEGO, CA Challenger Jr. High School's Technology Club will operate Station KI6YG to commemorate the 6th Anniversary of the Challenger Space Shuttle tragedy. Operation will be 1500-2400 UTC on the Novice phone portion of the 10 meter subband. For a special commemorative QSL card, send QSL and SASE to ***Challenger JHS, 10810 Parkdale Ave., San Diego, CA 92126.***

JAN 29

SIDNEY, ME The James Bean Elementary School ARC will operate N1IFP from 1200-2100 UTC to commemorate Sidney's Bicentennial. Operation will be on 7.265, 14.265, 21.365 and 28.465 MHz. For certificate, send QSL and SASE to ***N1IFP, Bean School, RFD 3, Augusta ME 04330.***

Number 18 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy
N. Swanzey NH 03431

Notes from FN42

As I am writing this, face-to-face communication between Israel and Palestinian representatives is taking place in Madrid, Spain. You might have noticed that I did not say that they were just talking, I said that they were communicating. Is there a difference in what the two words mean?

There very definitely is a difference! Talking means that there is one-way movement of information. It does not mean that anyone is really listening or understanding on the other end. But communicating means that there is a sender and a receiver, and if true communication takes place the receiver understands the sender and gives feedback to the sender. Of course, just because they are communicating doesn't mean that a settlement will be reached that will be acceptable to all, but this type of communication is certainly better than face-to-face looking down a rifle barrel.

During the past few months we have been watching meaningful communication take place in the Soviet Union. People are not just talking, they are also listening. Communication is taking place, just like hams have been doing for years and years! But hams also have their problems. Hams are not perfect either.

As we end 1991 and enter 1992, let us all attempt to truly communicate with each other and make 1992 the best year ever for world peace and prosperity. It's the only world we've got —Arnie N1BAC.

Roundup

IARU Information downloaded from the US packet radio system, distributed by Clark Campbell VE3KSQ for Tom Atkins VE3CDM, Secretary, IARU Region 2.

The Union of Swiss Short Wave Amateurs (USKA) has developed many agenda items, including four that are of interest to amateurs: (1) The possible extension of the frequency spectrum allocated exclusively to broadcasting which should come from the bands allocated to the fixed service; (2) & (3) The consideration of the allocation of frequency bands to broadcasting-satellite and mobile-satellite service and the associated feeder links; and (4) To develop new recommendations and resolutions in relation to the agenda of the conference, including meteorological aids service in frequency bands below 1,000 MHz and present allocations to space services above 20 GHz.

The Radio Amateur Society of Thailand (RAST) recently met with officials of the Thai Post and Telegraph Department regarding Thai participation in WARC-92. The Thai delegation will not be represented by an amateur but by Mr. Rienchai Reowilaisuk, Director of Frequency Management at the Post and Telegraph Department. Mr. Reowilaisuk attended the April 1991 Amateur Radio Administration Course in Tokyo and will hopefully champion the amateur efforts.

Mr. Alon Bar Sela, representing the Israeli Ministry of Communications, spoke to approximately 400 members of the Israel Amateur Radio Club (IARC) at their annual general membership meeting on May 9, 1991. He gave assurances that the Israeli delegation to WARC-92 will be a staunch supporter of amateur radio and will do all it can to defend the amateur bands.

Amateur radio was well represented at the 20–21 May 1991 WARC-92 preparatory meeting of the Association of Southeast Asian Nations (ASEAN), in Kuala Lumpur. Attending at the invitation of the Director-General of Telecoms, Malaysia, were the Director of the IARU Region 3 Association, Mr. D.D. Devan 9M2DD, and the WARC-92 liaison officer from the Malaysian Amateur Radio Transmitters Society (MARTS), Mr. Sangat Singh 9M2SS. Present at the meeting were 31 representatives from Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, and Thailand.

At the request of the Telecommunications Department of Malaysia, both Devan and Singh presented a paper, "The Case for Amateur Radio in View of Possible Revision of Frequency Allocations at WARC-92," which was subsequently adopted as part of Malaysia's position and distributed to all delegates as an official document. Other amateur presentations followed. The head of the Malaysian delegation asked the meeting to take the interests of amateurs into consideration during their deliberations.

Two papers from IARU Region 1 have been presented to the European Conference of Post and Telecommunications Administrations (CEPT) Working Group "WARC-92" meeting in Sweden in mid-June 1991. One of the papers covered the 7 MHz issue. The IARU fully supports the CEPT approach, which proposes to separate the issue of harmonization of allocations in the vicinity of 7 MHz from the total HFBC package. The CCIR Report to WARC-92, Chapter 4.2, states that "the sharing of frequency bands by the amateur and the broadcasting service is undesirable and should be avoided" and is an "existing undesirable compatibility situation."

The other paper discussed the sharing arrangements that now exist between the amateur service and other services, and the proposed spectrum rearrangement. This paper offers solutions which will protect the interests of all the services involved *[too lengthy for inclusion here]*.

From IARU Region 2 News Service, Tom Atkins, VE3CDM, Secretary IARU Region 2. Address inquires to: Clark Campbell, VE3KSQ, 10-101 Kent St., London.ON.CAN N6A1L2 or VE3KSQ @VE3KSO.ON.CAN.NA.

Israel/USA Downloaded from packet radio: An electronic issue of the *Israel Ham News* is available on the K2UK packet BBS. The issues may be secured by the REQFIL @ K2UK.NJ. USA technique. Please be SURE that you spell the file name absolutely correctly. The example Ed used was for the October 1991 issue: ISRAEL-NEWS1091.PT1, .PT2, .PT3, .PT4, which has 4 parts, each approximately 2K or less in length, and each part must be requested separately. If you have any questions contact Ed at K2UK @K2UK.NJ.USA.

Photo A. The EK1NWB DXpedition bunch on the Island of Kizhi.

The Netherlands From Radio Netherlands Program Information Release, Sept.-Dec. 1991: Hi, we're back. This bulletin was suspended during some internal reorganisation at Radio Netherlands English department. This publication will continue until March 1991 when we shall replace it with a full-colour newsletter designed to improve our contact with listeners still further.

For any who are presently on or wish to be on our mailing list, please send your name and address to: Els van den Tempel, PIR List, English Department, Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, The Netherlands. If you have recently moved, please send the old address and ask for it to be deleted.

Our new booklist, Edition 13—August 1991, is available. The contents are broken down into eight sections: Listening Guides, Mass Market Periodicals, Books and Pamphlets for the MW/SWL, Broadcast Related Books for the SWL, Tape Recordings, Amateur Radio, Vintage Wireless, and Specialist Addresses. If you wish a copy of the Booklist contact Jonathan Marks at the previous address, or FAX: +31 35 724352; Tel: +31 35 724211.

Ukraine (USSR) The following report was received from Alex Shestakov UT5UNX: The DXpedition organized by the Karelian DX Club • Kivach • (Photo A) took place on the island of Kizhi from July 25 to August 8, 1991. The island is one of the most wonderful islands on Onega Lake. Kizhi is well known for its wooden temples, the most marvelous one being Preobrazhenskaya Church (Photo B), which was built in 1714. There are 22 aspen domes in five levels on the top of the church.

Time is very damaging to the temples, and they are getting dilapidated without proper care. But restoration requires much money. All money which was received by us from selling emblems, pictures, and photos was sent to the 18th century architecture restoration fund. Previous help was received from Finnish colleagues who were here in 1990.

This was the second DXpedition on Kizhi. The stations which participated were UA1NDR, UA1NEG, UA1NEQ, UV3VJ, UA3SDT, UA3SET, UT5UNX, 4K4QQ, and others. EK1NWB was the base station of the Karelian DX Club, working almost every day.

Photo B. The Preobrazhenskaya Church on the Island of Kizhi.

Equipment used was Soviet and foreign, including UW3KI, FT-270, UA1FA; and RTTY was produced by the Tula radio amateurs. Antennas used were 9 meter ground plane, 2-element quad for 14–21–28 MHz, and inverted Vs for 1.8 and 3.5 MHz.

We plan to do one more DXpedition to the Isle of Kizhi and other islands of the Solovetsky archipelago. You might remember that Mr. Solzhenitsin has written about some in his book, *Archipelago Gulag*. 73 from Alex A. Shestakov UT5UNX, P.O. Box 15 Kiev 91, 253091 Ukraine, USSR.

From Boris "Bob" Grebenichenko, UB5UCH: There is a Jubilee Medal available commemorating the 65th anniversary of the first radio contact between the USSR and the USA. "Radio Amateur Ivan Nikitin for the Kiev Province was the first to have taken the signals of 'WOC' American radio station from the state of Iowa and received official confirmation about it." *Radiolubitel Magazine*, July 1926.

This big ceramic medal is awarded for working 10 USSR stations and 10 USA stations. One QSO with Obi 065 and the state of Iowa must be represented. All stations in Obi 065 will use the following prefixes: UB5U, UB4U, RB5U, RB4U, and the special callsign for this celebration, URØUCH. QSO valid for any time, mode, and band. No QSL cards, only GCR list with US$5 or 15 IRCs. Send registered mail only to: UB5UCH, P.O. Box 1, Obukhov-1, 255400, Ukraine, USSR. SWLs use the same rules. USA stations should send the same information to: Bill Aspin WI8R, 188 N. Mieliens Rd., Munger MI 48747.

Taras Zima, UB5LSL has sent a letter to explain his OSL card service. His address is: P.O. Box 43, Komsomolskig, Kharkov obl., 313750 USSR. His rate is US$1 per three cards.

PORTUGAL

Mike Lazaroff KB3RG/CU3LF
PCS 76, Box 1687
APO AE 09720

Hello once again from the Azores Islands! The Azores are a group of islands located in the North Atlantic, about 2,200 miles east of New York City and about 850 miles west of Lisbon, Portugal. Their total land area is about 922 square miles. The islands range in size from seven square miles (Corvo—CU9) to 297 square miles (San Miguel—CU2).

The islands are of volcanic origin and are quite mountainous, with numerous extinct volcanic craters. There are many varied wild flowers mixed in with the vegetation, which gives the islands a very pleasant appearance.

The climate is semitropical. Summer, which extends from June through September, is very pleasant. There is little rain, and temperatures commonly range in the mid-70s F. The winter is rainy and damp; however, the temperature seldom drops below the mid-50s, so we don't worry about digging out from under massive snowstorms.

In my next column, I'll write on the history of the islands and pass along some interesting statistics. Meanwhile, I'm sure the DXers out there will find some callsign and license information interesting. There are nine major islands in the Azores, and each is a separate call district. They are: CU2—Santa Maria, CU2—San Miguel, CU3—Terceira, CU4—Graciosa, CU5—San Jorge, CU6—Pico, CU7—Faial, CU8—Flores, and CU9—Corvo. CUØ is reserved for special event and commemorative calls. I had the callsign CUØWPX during the CQ WW WPX contest last March.

Temporary 30-day reciprocal operating permits can be obtained for a small fee from offices of the CTT (the local licensing authority). They can be renewed for an additional 30 days. These permits allow you to sign the Azores prefix/your call. Local callsigns are granted to hams living here or on assignment to the air base on Terceira. That procedure is somewhat complicated and unfortunately involves a bit of red tape. I will be happy to assist anyone coming here who wants to apply for a license.

Until next time, 73 de Mike, KB3RG/CU3LF.

SPAIN

Woodson Gannaway EA8/N5KVB
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de G.C.)
Islas Canarias
Espana

After receiving the September issue of *73* and seeing the photo of our clubhouse, imagine my surprise when, on my following visit, I found the clubhouse undergoing extensive changes! A second story is being added, the main meeting room enlarged, etc. Plans call for everything to be finished by the end of the next year, a tall order. But, with the prospect of a very exciting event taking place there next spring, it is worth it! And it helps keep us from getting bored.

In addition to the Spanish replicas of the *Pinta*, the *Niña*, and the *Santa Maria*, the Japanese have commissioned a copy of the *Santa Maria* which is now under sail, making the voyage that Columbus had intended to make. They left port here at Las Palmas two weeks ago *[the middle of August—Arnie]*, and expect to be in Japan in about 10 months. Curious as always, I went down to look at her. Dinky! That's the first word that comes to mind when I see those ships (there is a full-size copy in Santa Cruz de La Palma, on land). Crowds kept me from going on board this one, but my eye found a small antenna for around 2 meters, certainly for communicating with its mother ship. The mother ship, *Yaiza 2*, had plenty of antennas but I was unable to find out if there was any amateur radio activity in addition to its official ship radio communications.

Photo C. The group of expeditioners on Piallazza Island, with antennas and accommodations in the background.

Old Ben Franklin really comes to mind often; for instance, "If we don't hang together we will surely hang separately." While we were in Madeira (in the mountains, not in Funchal) a friend caught the first uncertain news about the attempted coup in the Soviet Union on his shortwave radio, in Arabic! The next day he found a fading Spanish station and we got some details. Here we were, people from half a dozen different places gathered to help celebrate the first Baha'i Summer School of Madeira, all being affected by what was taking place in the USSR! The Russian teacher at the Translators and Interpreters School speaks fluent Spanish and I enjoyed talking with her about her native Armenia, the smallest Soviet Republic. We have no business meddling, but we'd sure better learn to cooperate. It doesn't take too much imagination to see us hanging separately, and soon, if we don't.

So until next time, 73, Woodson EA8/N5KVB.

ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
20129 Milano
Italy

It's been a long time since I have sent something to "73 International." I hope that what I have sent is worth the wait.

Expedition to IL4

Island hunting is becoming more and more popular. There are several awards in Europe, apart from the very popular IOTA. You can find the Italian Island Award, the French Island Award, and now the Spanish Island Award.

The best season for an expedition to an island is summer. The weather is nice, propagation is still reasonable in this period of the cycle, and it is holiday time. So, what better idea than to take a lot of radios and antennas and go somewhere with your friends.

This is what we do from time to time. Photo C is a picture taken on the trip we made to Piallazza Island, IL4.

Photo D shows the QSL card of IY1TTM, the call for Torre Marconi in Sertri Levante, about 50 km from Genova, Liguria, on the top of a hill 70 metres above the waters of the Golfo del Tigullio, Ligurian Sea. The tower, 10 metres high, was built in 1200 as a sighting point. Since 1971 it has been looked after by the radio amateurs of Sestri Levante who belong to the Italian Amateurs-Radio Association. TTM is the acronym for Tigulllo-Torre-Marconi. I2DMK is the primary operator and I2MQP is the QSL manager.

Guglielmo Marconi (1874–1937) used this tower for his studies on ultrashort waves (UHF) and on the microwaves, his third discovery after the broadcasting aerial of 1895 (complex radiating earth-aerial) and the short waves for communicating over large distances. Marconi also executed tests of broadcasting studies on television and on radar at the tower.

A contact with IY1TTM is valid as a commemorating station, as required by the regulation of DGM, Diploma Guglielmo Marconi. It is fascinating to work from the very point where the "Father of Radio" executed some of his great inventions devoted to humanity.

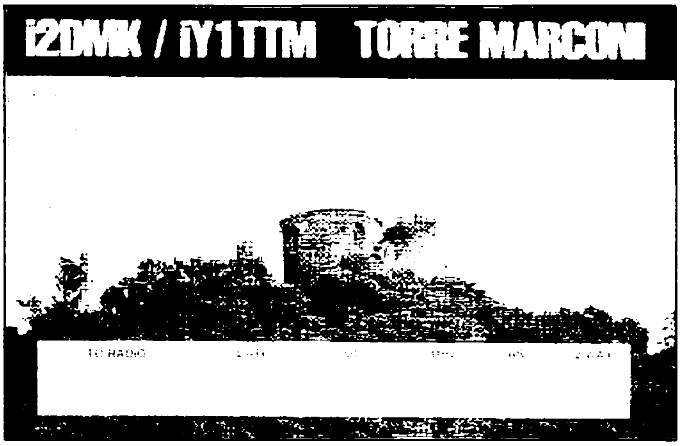


Photo D. The QSL card for Torre Marconi.

ATV

Ham Television

Bill Brown WB8ELK
℅73 Magazine
Forest Road
Hancock NH 03449

ATV Touch-Tone Controller

Last month we took a look at the ATV jet system designed by Bill Walker WB1ADF and Bill Kinton NX1D. This time we'll show you how they remotely controlled the jet's ATV transmitter by touch-tone commands via a VHF uplink.

Bill Kinton NX1D designed the touch-tone controller for this project so that it would fit neatly inside a PC Electronics TC70-1 ATV transceiver. A 44-pin card-edge connector (RS# 276-1551) was installed inside of the TC70-1 with connections to the "push-to-look" switch, the audio and the microphone inputs, as well as to the two camera inputs (see Figure 1 for edge connector pinouts). The final controller circuit, as shown in Figure 2 (see page 60), is capable of selecting between two video and audio sources and can turn the ATV transmitter on and off. In addition, the controller can key a relay to activate an external power amplifier.

The Circuit

Audio from a VHF HT is routed to both the microphone input of the TC70 and the input of the SSI202P touch-tone decoder chip. This way, ground stations can actually use this system as a remote audio repeater (2 meters or 220 MHz in—ATV audio subcarrier out). When a valid touch-tone command is decoded by the SSI202, a unique 4-bit output results. This is hooked into a 4-to-16 line decoder IC (4514) which gives you an output corresponding to the number you pressed. This is only active as long as you hold down the touch-tone pad, so a few 4013 flip-flops latch the outputs either on or off until reset. The video and audio paths from the two TV cameras are routed through a 4066 analog switch which is controlled by the output of one of the flip-flops. For example, touch-tone #3 will cause the video and audio from camera 1 to be selected. When #4 is pressed, the 4013 flip-flop (U2A) is reset, which selects camera 2.

In a similar manner, touch-tone command #1 keys the TV transmitter on, and touch-tone #2 turns it off. Commands 5 and 6 key a relay on or off to control the external power amplifier (if used). There are a number of unused outputs which can be used for additional features.

Installation

In order to fit inside the TC70 and be easily removed, Bill built the controller onto a Radio Shack protoboard (RS# 276-154). The nice thing about this particular protoboard is its built-in 44-pin edge plug. With the front panel of the TC70 facing you, mount the edge connector inside along the left panel. Referring to Figure 1, the top row of the connector is numbered from 1 to 22, and the bottom row is labelled A to Z. In addition to the four optional LEDs, mount a ⅛-inch phone jack and an RCA phono jack as shown. Wire connections to the various controls and switches inside of the TC70 also as shown in the diagram.

Once you've completed your controller board, just plug it into the connector inside of the transceiver. Hook up your video and audio inputs to the TC70 as you normally would. Attach an audio cable from your HT or VHF receiver and plug it into the new audio input jack on the side of the TC70. Adjust R14 for reliable touch-tone decoding and R15 for proper volume into the TC70 microphone input. You now have a remotely controlled ATV transmitter.

Next Month

In my next column we'll show you a complete circuit board pattern along with a parts placement for the touch-tone controller which should make assembly a real breeze. ■

Continued on page 60

Parts List

IC1,2,3	4013 CMOS flip-flop
IC4	4514 CMOS 4-to-16 line decoder
IC5	SSI202P touch-tone decoder
IC6	4066 CMOS analog switch
IC7	7805 5-volt regulator
Q1,2	2N3904 transistor
C1,2,4,7,9,11,13,15	1.0 µF tantalum
C3,8,10,12,14,16	0.01 µF
C5,6	680 pF
R1	47k
R2	3.3k
R3,4,5,6,10	4.7k
R7	10 MEG
R8,13	10k
R9	6.8k
R11,12	1k
R14,15	5k potentiometer
LED1-4	Green or red LEDs
XTAL	3.579 MHz colorburst crystal
PCB	Radio Shack protoboard with edge connections (RS# 276-154) or PC board as described in note below.
Misc	44-pin edge connector (RS# 276-1551).

Note: An etched and drilled PC board designed to fit a 44-pin edge connector is available for $9.50 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

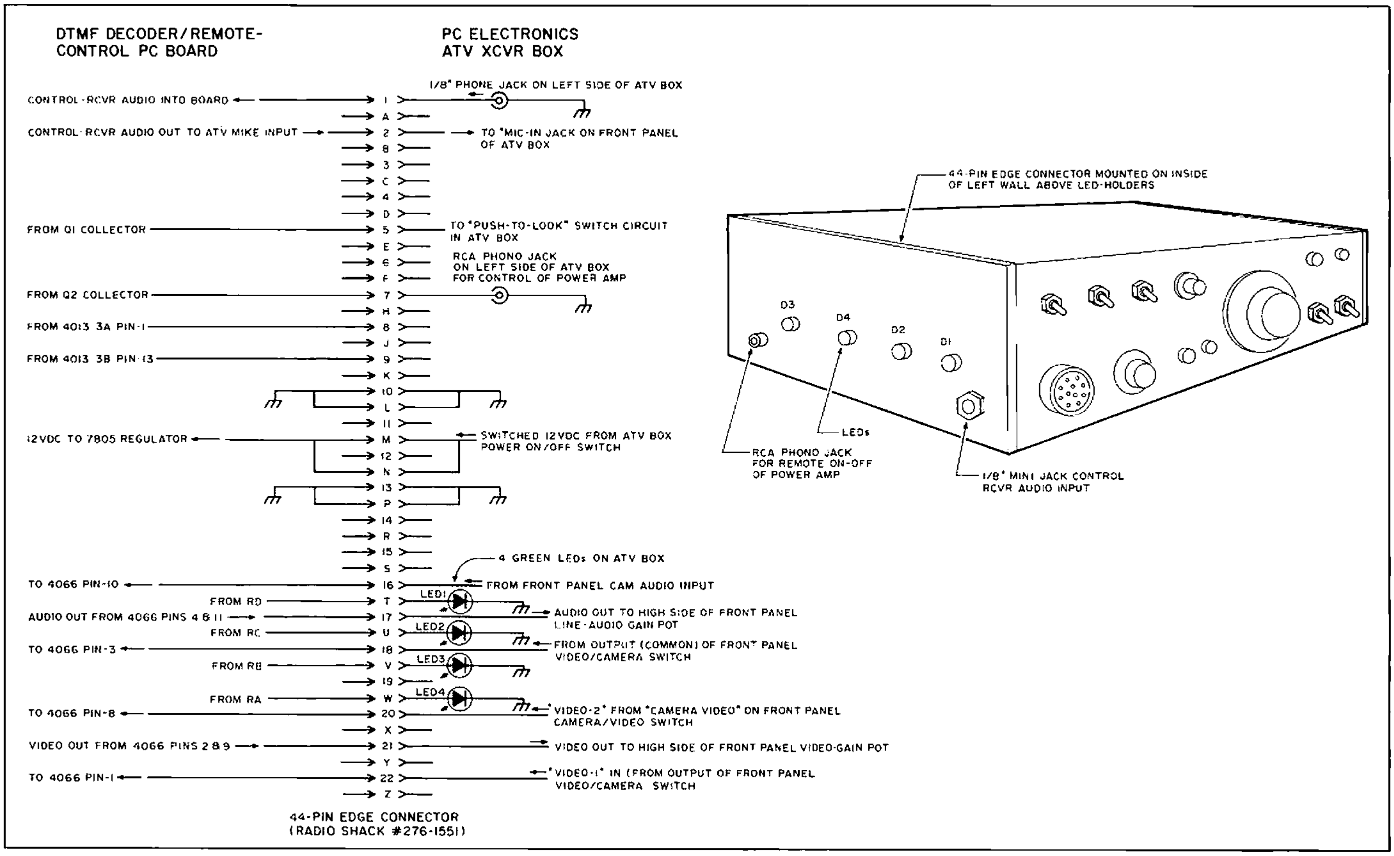


Figure 1. Edge card connections (mounted inside the PC Electronics TC70-1 ATV transceiver).

MARS Experience

Continued from page 36

the full-time post MARS stations didn't help is still a mystery.

MARS provided much more than savings. It was often the only communications our unit had to home base. Essential communications were made over MARS that would not have been accomplished without it. There is not a single battalion commander or staff section who did not use, and use frequently, the MARS system. Normal communications were so poor that even the Red Cross sent messages through MARS to get them delivered after failing through all other means.

One case in particular was very bad. A young soldier's brother had died, and the family had been attempting contact with him for over 10 days. He got his message just the day before his brother was to be buried. This was not an isolated case.

Similarly, MARS stations in Germany and the States stayed on many hours without being used. Lower level (battalion) MARS stations could have been instituted from the beginning had systems been in place. But the Army in general, and armor (tank) units in particular, seem to be very shortsighted when it comes to communications.

Our brigade and community stations are both on the verge of being shut down. We have only one last chance...if the new Nuernberg Community Commander, General Wilson, will agree to man it, one station may remain on the air. If not, we will not only lose the licenses but quite likely the equipment as well. Even though it was purchased with community funds, 5th Signal Command may take it away from us just as they took the entire Ansbach station only a year ago. And that equipment was purchased by the Officers Wives Club!

I should be happy...we went to war...we survived...we helped many soldiers.... So what's the problem? I don't know...I just have this sinking feeling that won't go away.

Many wonderful things happened on the air with MARS. Marriage proposals, experiments with antennas (have you ever had an entire desert to set up as much antenna as you wanted?), re-unions, marriages saved. All because some hams were committed to putting it all together....

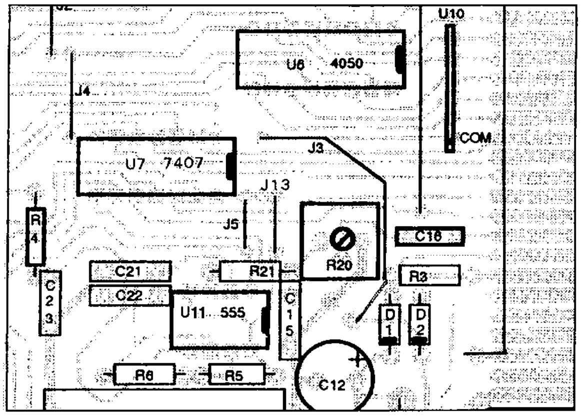
A very special thanks to those who kept the home fires burning and their end of the MARS system open: SSG Scott Hoffman DA2SC/N4SXP, without whom AEM1ELN and AEM1NBG would never have succeeded; Nancy Tilton DA1KS/KA3NDB; Don Goff DA1DD; and Helmut Boehm DL4NDK/AA7FS. Most of all thanks to my lovely wife Pat DA2WP/N4ROC/AEM1WP, who never ceases to amaze me and continues to be my inspiration day by day. We did good! 73

SSG Michael R. Warner NX7T, Box 5961, Headquarters Second Brigade, 1st Armored Division (3rd ID) APO, NY 09066.

UPDATES

Parts Placement Error

See "Microprocessor Repeater Controller, Part I," starting on page 28 of the October 1991 issue. The author, John Bednar WB3ESS, writes: "I discovered an error in the parts placement diagram on page 34. Jumper J3 should connect the common end of U10 to 12 volts. The jumper end near R20 should go to the pad connected to diode D2, as shown in blue in the figure.



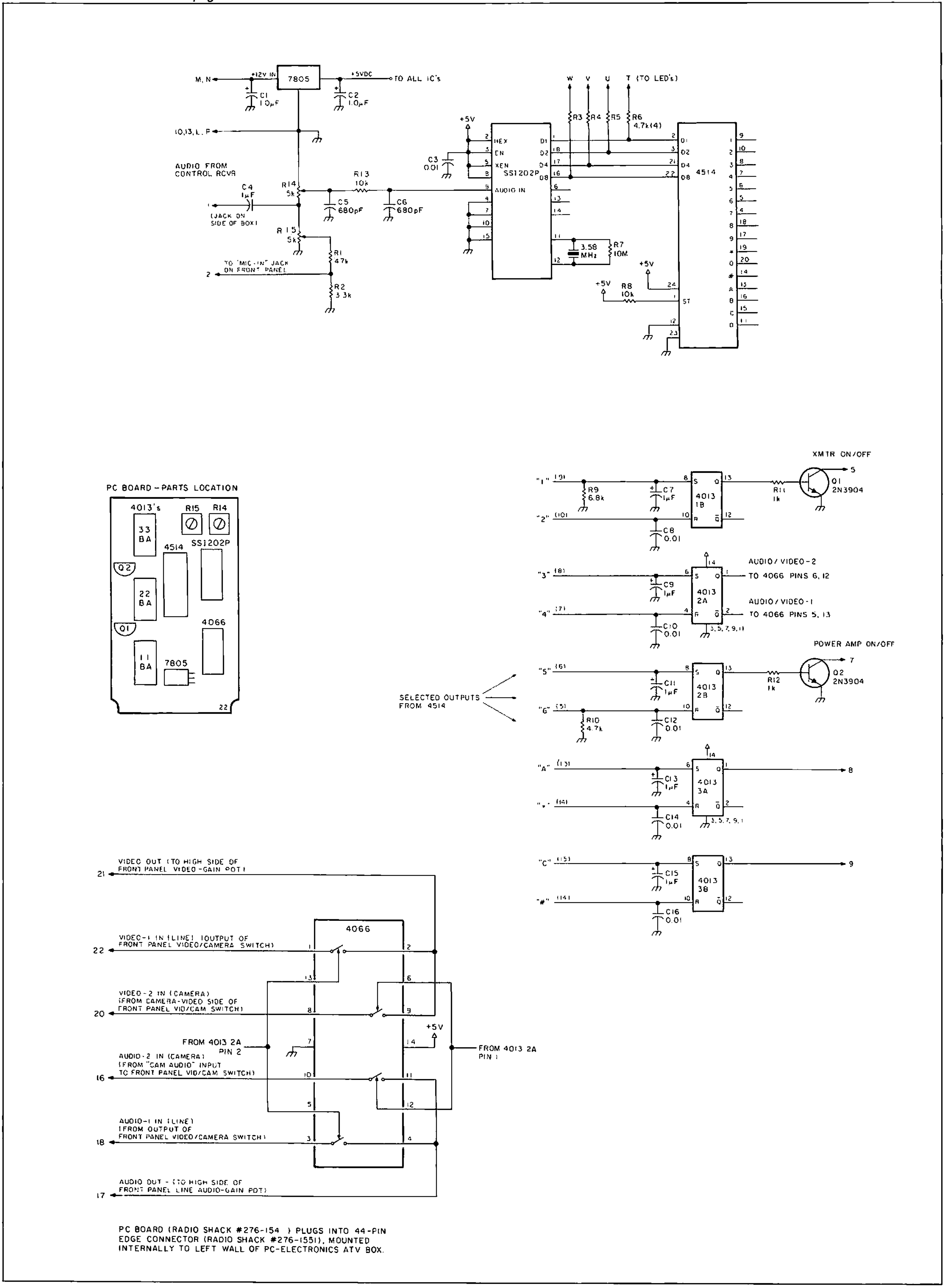


Figure 2. Schematic diagram of the touch-tone controller.

Number 21 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Mike's Rules of Twenty?

With the cold days of winter upon us, many hams turn to the bench for some winter projects. Getting all the parts for your latest project can sometimes be more of a hassle than getting the project running. Some time ago I described Mike's "rules of ten." Since the mail has been running heavy on obtaining small parts, it's time to update the rules.

In a nutshell, Mike's "rules of ten" are very simple. You order in lots of 10 to meet the minimum order amount (ten bucks) and wait 10 days for the parts to arrive.

Since this first came out in the October '86 "QRP" column, things have changed. First, it is almost impossible to find a part supplier with a minimum order of ten bucks. Nowadays, the minimum is closer to twenty bucks.

Jameco Electronics

Some of the suppliers since 1986 have gone almost entirely to computers and computer accessories, dropping most of their line of electronic parts. This seems to be the current trend at Jameco Electronics. With a minimum order of $30, which most of us can't afford to generate for a few parts, Jameco is no longer a good small parts supplier.

Photo. A hamfest bargain: a penny a microamp meter!

Circuit Specialists

A real old-time supplier of parts, Circuit Specialist, is stocking more and more computers and computer parts, but they're also still hanging onto the pieces and parts home-brewers need. They have a minimum of $20 for plastic money, or $10 for checks or money orders. They offer fast service and a large array of parts, from transistors and FETs to resistors and pots. They're one of my favorite suppliers—best price for resistors anywhere around! Phone: (800) 528-1417 or (602) 966-0764.

Mouser Electronics

Then there's Mouser Electronics. I was a bit leary of ordering from this company; somehow, I had this idea in my head that you had to have a letterhead and a Dunn and Bradstreet rating to place an order. Whoa! Was I wrong. Mouser could become the standard in part ordering, and perhaps mail-order in general. I'm serious!

Mouser has a minimum order of $20. Just about every credit card you can think of is honored. A toll free number is available for orders as well as for customer service.

With four regional distribution centers, Mouser can give you next day service just about anywhere. All orders are shipped the same day. When I order by phone, one of the very helpful phone operators takes my order, then checks for availability of the parts I just ordered. No surprises when the order arrives. The operator lets you know if any of the parts you have ordered are out of stock, and when they might come in. I have had parts orders shipped from three different distribution centers, all to arrive on my door step the very next day (using UPS next day shipping).

Mouser stocks just about everything you need. is there a down side to all this? Well, some of the parts are a bit higher in cost, compared to what some of the other suppliers charge. But the difference is not overwhelming, considering all the service you get. Mouser gets my highest rating for QRP parts. Phone: (800) 346-6873.

KA7QJY Components

Here's a vendor that was not on the list in 1986: KA7QJY Components, P.O. Box 7970, Jackson WY 83001. Danny supplies a fine line of parts for the home-builder. There is no formal catalog, but rather a large sheet of components available and their prices. This list changes all the time, and Danny runs a lot of specials on transistors and other parts the QRPer uses. There is no minimum order, and you can't use your plastic. There is a shipping charge of $2.50 for each order. All the parts supplied by Danny are brand new, but they may be surplus. By buying surplus, sometimes you get a better part. If you want good quality parts, from transistors to cores, KA7QJY Components is a home-brewer's dream come true.

One thing you should know about some of the parts supplied by KA7QJY is that they might be "house numbered" parts. OK, what in the world is a house numbered part? It's simple. It's a number the manufacturer stamps on a part for a particular customer. If you have ever assembled a HeathKit project, you've worked with house numbered parts. They were called Heath part numbers. A 2N2222 may be numbered as 417P234. Same part, same

specifications, just a different number stamped on it.

One of the benefits of house numbered parts can be described in one word: price! In many cases, the house numbered part will be of higher quality. Some house numbered parts have to meet military specs.

All Electronics

All Electronics supplies house numbered parts, *and* a variety of surplus parts, at very good prices. They accept plastic money with a minimum order of $10. They're a good supplier for silver mica caps and high wattage resistors. Phone: (800) 826-5432.

Oak Hills Research

The last vendor is Oak Hills Research, 20879 Madison street, Big Rapids MI 49307. They offer complete kits for QRPers as well as parts. There is no minimum order if you pay by check or money order. There's a $15 minimum order if you want to use your plastic. It's a great source if you need only one or two transistors for your project and you don't want to brother with large minimum orders.

Of course, there are many more suppliers of parts, kits and circuit boards out there. This is only a sample of those I've had good results with.

Other Parts Sources

Don't forget to check out the local Radio Shacks. They offer parts when you really have to have them, like late at night on a Saturday. Sure, they're expensive, but they do stock a lot of parts that might come in handy in a pinch.

And then, of course, there are hamfests. These are great for picking up boxes, variable capacitors, transformers, and the like. I kind of stay away from transistors and other active components. Sometimes you don't know where the parts came from, or if they're any good.

And you won't be able to find the guy next time if they aren't. The meter In the photograph is a hamfest special. About the size of a quarter, this 0–100 microamp meter sold for a buck. That's a penny a microamp! I bought all the meters the guy had. Without a doubt, you'll be seeing them in upcoming projects.

For circuits boards, don't forget about Far Circuits, 18N640 Field Court, Dundee IL 60118. Send a large SASE for the latest list of PC boards.

Mike's Rules of Ten Still Good

Order in lots of ten, order the minimum, and wait ten days. That's Mike's "rules of ten"!

Next month I hope to have a project underway, so dig out the soldering iron and get it ready. If you did not get your copy of the *HW-8 Handbook*, you're out of luck. All copies have been sold. A reprint? Not likely, but who knows? ■

Number 22 on your Feedback card

DEALER DIRECTORY

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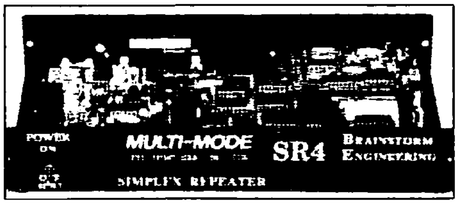
DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '91 issue must be in our hands by February 1st. Mail to *73 Amateur Radio Today*, Box 278, Forest Road, Hancock NH 03449.

NEW PRODUCTS

Compiled by Hope Currier

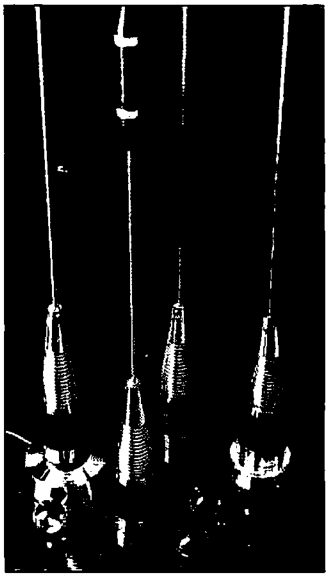
BRAINSTORM ENGINEERING



Brainstorm Engineering has introduced the Multi-Mode SR4 Simplex Repeater, a fully self-contained, microprocessor-based, remote-programmable controller. The SR4 is capable of operating one or two radios in simplex repeater, split simplex repeater, duplex repeater controller, voice mail and voice IDer modes, separately or simultaneously. No duplexer is necessary if you use one radio and one frequency. The SR4 will store and forward any audio messages being received by the radio to which it is connected, allowing two or more radio operators to communicate when they aren't in range of each other but are in range of the simplex repeater site.

Prices start at $399. For more information, contact *Brainstorm Engineering, 2948½ Honolulu Ave., La Crescenta CA 91214; (818) 249-4383, FAX: (818) 248-0840.* Or circle Reader Service No. 201.

THE ANTENNA SPECIALISTS



The PRO-5000 series from The Antenna Specialists is a new professional line of high-durability VHF and UHF mobile antennas featuring three O-rings for absolute moisture integrity. The 22 models encompass all mounting applications and all the various frequency splits in both the 138–174 MHz and 406–512 MHz bands. Each includes a 100% hand-tuned-and-tested conical coil with stable soldered connections for noise-free operation. The VHF antennas are rated for 3 dB gain; the UHF antennas include both 3 dB and 5 dB gain models. All have maximum VSWR of 1.5:1.

For prices and more information, contact *The Antenna Specialists Co., 30500 Bruce Industrial Parkway, Cleveland OH 44139-3996; (216) 349-8400, FAX: (216) 349-8407.* Or circle Reader Service No. 202.

SENSIBLE SOLUTIONS

Sensible Solutions has announced the release of Version 4 of the WB2OPA LogMaster HF logging system for PC compatibles. This latest version allows users to connect to and monitor their local DX PacketCluster bulletin board system while simultaneously performing logging functions. Kenwood and ICOM computer-ready radios (Yaesu and Ten-Tec are being phased in—call for availability) can have their frequency set to that of the DX "spot" announced over the cluster, at the touch of a button. The program also allows the user to send a DX "spot" announcement, automatically formatted or from their log book. The LogMaster provides an automatic "needs" indicator that checks the log book to see if the country, state, prefix, CQ zone or ITU zone are needed as information is input. The program prints QSL cards and labels, will import K1EA CT files, provides unparalleled logging statistics, has a built-in English-to-metric and metric-to-English conversion calculator and an auto beam heading indicator.

The program requires 512K of memory, a hard drive or dual floppy drives. The program costs $69.95, including S & H; a demo diskette is available for $5 (refundable with purchase). Contact *Sensible Solutions, P.O. Box 474, Middletown NJ 07748; (800) 538-0001, (908) 495-5066.* Or circle Reader Service No. 203.

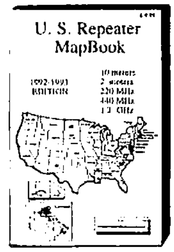
MARINE ELECTRONICS

Marine Electronics has announced a new software release for computer control of the Kenwood 440 and 940 units. SUPERLINK is a graphics-based program with special emphasis on ease of use. All input is via the keyboard, and all functions are controlled by a single keystroke. Frequency information is displayed digitally, but a unique analog dial makes visualization of position in the spectrum much easier. A complete memory subsystem allows unlimited memory capability with each memory having a field for comments. Multiple types of scanning are available, and scan delay is user adjustable.

SUPERLINK is priced at $19.95, plus $2.50 S & H. Contact *Marine Electronics, 1309 Crawford Dr., Friendswood TX 77546..* Or circle Reader Service No. 204.

ARTSCI PUBLISHING

ARTSCI Publishing has released the 1992/1993 version of the *U.S. Repeater Mapbook* (8½" x 5½"), updated and cross-checked with the *ARRL Repeater Guide*. This version has two new additions: Canadian repeaters and U.S. 10 meter repeaters. This useful companion for traveling hams contains full-page state maps showing major cities and highways, plus the locations of the most popular wide-coverage repeaters.



The *U.S. Repeater Mapbook* is available for $9.95 at amateur radio stores nationwide. For more information, contact *ARTSCI Publishing, P.O. Box 1848, Burbank CA 91506; (818) 843-4080, FAX: (818) 846-2298.* Or circle Reader Service No. 206.

ELECTRONIC EQUIPMENT BANK

The Electronic Equipment Bank is offering a new, expanded 1992 catalog. With a new professional format, this catalog covers shortwave, amateur and scanner radios, and also includes pages of accessories, hundreds of books, and a new specialty hi-tech section. The catalog is free (bulk rate mail) in the U.S., $2 in Canada, and $3 elsewhere. Contact *EEB, 323 Mill Street, N.E., Vienna VA 22180; (800) 368-3270, (703) 938-3350, FAX: (703) 938-6911.* Or circle Reader Service No. 205.

EAVESDROPPING DETECTION EQUIPMENT

Caller Identification units are monitors that show the phone number of incoming calls before you answer your phone. If you're away from your home or business, the Caller ID will store the incoming callers' telephone numbers, along with the date and time of the calls. Caller ID has proven beneficial to businesses as well as residential customers. Pizzerias, exterminators, cab companies, etc. have seen a decline in prank orders due to this system. Mail order houses are now able to process orders more quickly.

Caller Identification units from Eavesdropping Detection Equipment retail for $69 to $119.95, depending on the features offered. Your local telephone company must provide Caller ID service in order for the unit to operate. EDE also markets a complete line of surveillance and countersurveillance equipment. For more information, contact *EDE, P.O. Box 337, Buffalo NY 14226; (716) 691-3476.* Or circle Reader Service No. 207.

PERSONAL DATABASE APPLICATIONS

Personal Database Applications has released version 2.1 of LOGic, featuring over 50 enhancements to version 2.0 of LOGic and LOGic Jr. Version 2.1 features a rapid online awards progress facility which shows in chart form status per band and mode, as well as mixed single, single-mixed, and mixed-mixed. You can easily see if an item is confirmed, waiting for a QSL, worked but no QSL requested, or unworked. An online summary shows how many are confirmed, QSL waiting, worked and unworked. The chart is updated automatically. These features will work for common awards and for any award in which you try to work all of a defined set of entities.

For the price and more information, contact *Personal Database Applications, 2616 Meadow Ridge Dr., Duluth GA 30136-6037; (404) 242-0887, FAX: (404) 449-6687.* Or circle Reader Service No. 208.

Number 25 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Avenue
Saugus CA 91350

Potty Training

Last October, the Southern California public learned what hams have known for a long time: Not every licensed amateur abides by the rules, and the FCC really has no interest in changing some of what goes on over the ham radio airwaves. So says an article titled "Radio Renegades" that appeared in the October 2, 1991, issue of the *Los Angeles Times*.

"Radio Renegades" was written by *Times* staff writer Bob Pool. It details the activities of some of the hams on the Los Angeles 147.435 MHz repeater. Some of its regular users have nicknamed it the "Notorious .435 Repeater." It is a system known nationally as a haven for advocates of freedom of speech and freedom of expression. Not so widely known is that sometimes this freedom of expression takes the form of personal verbal abuse, name calling, threats against life and property, and lots of potty-mouth language. It has also become a haven for numerous unlicensed operators who routinely interact with some of the licensed hams, though they are by no means welcomed.

Unfortunately, "Radio Renegades" shows only the seedy side of life on .435. I know that it may be hard for some of the locals in Southern California to believe, but .435 used to be the center of attention for many of the pioneering efforts in the areas of community service, technological development and public discussion. For example, some two decades and several licensees ago, the users of .435 (as WR6ABE), along with user groups of two other area systems, began visiting hospitals to bring a bit of sunshine to young patients who would not be home for the Christmas holidays. Using their radio gear, they would let these bedridden children chat for a few moments with old St. Nick. This concept was exported nationally and became known as "Operation Santa Claus." (Maybe your club or repeater group runs an annual "Operation Santa Claus" event. I'll bet you never knew that it all started on the "Renegade Radio" repeater in Los Angeles, with the designation of .435.)

The problem of potty-mouthed operation is not limited to one repeater in the City of Angels. If you travel and carry a 2 meter HT, then you know that a number of other big cities are developing ham radio "trash bins" of their own. These repeaters serve only as a kind of dumping ground for all of the community's less-than-desirable operators so that everyone always knows where they are corralled. Kind of the "NIMBY Syndrome" of amateur radio (NIMBY: Not In My Back Yard).

"Well, it's just those no-code Techs and their 2 meter rigs that are the problem!" Guess again. The problem existed long before there was no-code, and it is far from isolated to VHF. All you need do is tune across either 40 or 80 meters almost any night and, depending on where you live and on band conditions, you may get to hear some language that would make the proverbial "sailor" blush. And, lest we forget, some long-term name calling has been a part of the upper end of 20 meters for almost a decade. No, it's not something isolated to my back yard; it appears to be a national problem that is sitting in your back yard as well.

And why hasn't the government removed the offending operators from the air? At least one high ranking FCC official says: "Illegal transmissions are hard to track down, and the community standards test makes obscenity even harder to prove." According to Dan Emrick, Chief of Investigations and Inspections for the FCC, "It may be perfectly all right in New York City to make dirty references to your lineage, but if you did it in the Bible Belt you'd be run out of town on a rail. What goes in Southern California might not be acceptable in North Carolina."

The term for what Emrick is talking about is "Selective Enforcement." In other words, if this were broadcast radio and TV, then the community standards of where you live would be dictated by the type of language acceptable to the majority of those living there. In simpler terms, if the majority felt that the use of certain off-color words was proper in the workplace, in public and in the home, then it would also be proper for broadcasts. I can only guess at the way that the Commission is applying this analogy to amateur radio, but what the FCC seems to be saying is that a "repeater" in and of itself is a community of radio amateurs. Therefore, if that community is willing to accept potty-mouth operations, then why should the FCC intervene?

Obviously, this leaves open some rather interesting questions. If my analysis is correct, then the government may be able to get away with using the "community standards" excuse to permit localized filth on the ham bands, but what about the foul conversations you hear on the high frequency bands?

The ARRL Says It's the FCC

It seems that the ARRL has found out why the Commission is blankly staring at this problem that we all know exists.

The ARRL says that it is very much concerned about the FCC's refusal to prosecute potty-mouth hams and take them off the air. During the October 12, 1991, ARRL Forum at the Southwestern Division Convention in Scottsdale, Arizona, the League's first vice president, George Wilson W4OYI, was asked about the problem being caused by those operating the Los Angeles 147.435 repeater as outlined in the *L.A. Times* feature. Wilson, a lawyer himself, said that the problem of non-intervention was centered in the office of the FCC's General Counsel. He stated that "...content related stuff, we have a problem with. We have got a problem with the Commission on a national level in the General Council's office being concerned about First Amendment rights. They (the FCC) have had plenty of good opportunities to enforce it a lot stronger then what they have done."

Wilson went on to say that the League is extremely concerned about the problems caused by the abuses of the few, and is doing all it can to bring about change: "...I can't make you a promise, but I can tell you that it is a matter of deepest concern to me personally and to the League in general. Conversations are going on at all levels almost on a daily basis to try to break the log jam. But right now, we haven't been able to get the enforcement at the national level because the (FCC) General Counsel is concerned about the First Amendment." Wilson made it clear that the stumbling block was only the enforcement of problems of potty-mouth operations; the commission is still involved in stopping all other regulatory violations.

Conservative Court Could Bring Change

Many experts think that the FCC hasn't acted on this issue because it is probably fearful that any penalties it imposes would wind up being challenged in the Supreme Court. In the past, the court has usually sided with those demanding their right to use any foul language they please on the radio airwaves. The election of Associate Justice Clarence Thomas might bring a change.

The Thomas appointment now weighs the court very heavily to the conservative right. It would not be at all surprising to see a lot of the liberal interpretations of the past 40 years be altered or reversed. This could include the issue of a person's right to be a potty-mouth ham radio operator, if such a case is ever brought for review before the high court.

The FCC's position notwithstanding, many feel that "Radio Renegades" was a slap in the face to all amateur radio operators, especially after the story was picked up nationally by the wire services. You know, "If you can't do anything to solve the problem, then kill the messenger!"

Others take a different view, saying that it is the government, not amateur radio, that comes out on the short end of the "Radio Renegades" story. They say that "Radio Renegades" is the kind of negative publicity the government hates, that it is bound to cause at least a minor shake-up over at the FCC, and that the foul-mouths bothering our repeaters and our HF contacts will be taken off the air. I ask, "Will they?"

Packet Relief on Hold

Packet BBS sysops and owners of open repeaters who have been waiting for the FCC to act to relieve them of some of the responsibility for automatically retransmitted messages will have to keep on waiting, according to Tom Blackwell N5GAR of Dallas, Texas. Blackwell is one of the authors of RM 7649, a rule-making request that asks the FCC to place primary responsibility for the content of relayed traffic on the originating station, holding the relay stations responsible only on a secondary basis.

Keep in mind that I am writing this in early November 1991, so things may have changed a bit by the time you read it, but last summer Blackwell was told by one of of his legislators that the FCC would be acting on RM 7649 before the end of September. September blew into October, and nothing happened. Then Tom called us to say that he had received a letter from the Commission. In it, Robert McNamara said that RM 7649 would be combined with several other requests for regulatory relief that the commission has received from members of the amateur radio community.

The McNamara letter did not say what the FCC was contemplating, but action to combine regulatory requests usually means one of two things: Either the FCC is preparing to issue a Notice of Proposed Rule Making, or it intends to dismiss all of the requests in one fell swoop as having no merit or purpose. As we all learned as a result of Private Radio Bureau Chief Ralph Haller's talk at the ARRL National Convention, the concept of relieving packet sysops and repeater owners of responsibility for the content of communications is to be a part of any rewrite of Rule 97.113.

With the controversy surrounding that proposal, packet operators, sysops and repeater licensees remain in limbo, not really knowing what's legal to retransmit and what is not. According to an earlier conversation that I had with Blackwell, the hardest decision on what to keep from relaying falls to the voice repeater operator and his control stations. The current rules' interpretation makes censorship almost mandatory, and in real time. This, he said, was the primary reason for his filing RM 7649.

SBE

If you are involved in broadcasting, you might want to take note of the following item: The Certification Committee of the Society of Broadcast Engineers has approved the recognition of amateur radio activities for certification credits. Persons holding a valid amateur radio Extra Class license, who meet the service requirement for employment in the broadcast or broadcast related industries, will be awarded Broadcast Technologist Certification upon application. This recognizes that passing an Extra Class license exam demonstrates technical proficiency on a par with the old FCC Second and First Class license examination. Certification information and application forms may be obtained from the SBE national office in Indianapolis at (317) 253-1640. *[From a September 13, 1991, SBE news release.]*

Phones Out? Call the FCC

To end on a much lighter note, we offer this: The next time your phone goes out along with the rest of the phones in your neighborhood, federal regulators want to know about it immediately. The FCC has proposed new regulations that would require telephone companies to notify the government within 90 minutes of a telephone outage that involves 50,000 or more service subscribers and lasts 30 minutes or more.

The commission's proposal came after a summer that saw telephone companies fall short of being able to handle glitches brought about by the introduction of new technology, leading to numerous telephone outages across the United States. Last June, computer software problems knocked out over six million Bell Atlantic phone lines, while in July a million Bell of Pennsylvania customers lost service due to similar problems. The FCC says that it currently has no systematic way to become informed quickly of significant service disruptions, and no way of determining whether specific types of hardware or software are at fault.

To quote one of my favorite television personalities: "and so it goes..."

Number 26 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Dr.
San Diego CA 92119

30 MHz IF System Update for 10 GHz Transceivers

This month I'll cover the 30 MHz IF strip presented in my article, "10 GHz Fun," in the April 1990 issue of *73 Magazine*. This system is used in conjunction with a microwave oscillator and detector to form a complete 10 GHz wideband FM transceiver. Microwave burglar alarm units like the Solfan alarm are used for the microwave portion of the package. While this system is not very complex, it has developed a few wrinkles, which we will explore after reviewing the system.

The System

The PC board is based on a single chip FM receiver. This chip, a TDA-7000, has all the internal functions to provide for FM reception from the antenna, to low level audio output. The PC board includes an audio amplifier (LM386) which normally drives a headset. In addition to these two chips, the receiver portion includes a CA-3130 S-meter detector indicator circuit.

The transmit portion of the board is a single CA-3130 mike amplifier which drives the Gunn diode power supply adjust terminal (part of the LM-317 regulator) for wideband FM modulation. The remaining components are power supply regulators.

Bug Number 1

Like all projects, this system developed a few bugs. These problems, while not debilitating, did cause some head scratching. The problems consisted of: a PC board error on the mike input circuit (CA-3130); low sensitivity of the TDA-7000; and audio oscillation at high audio gain.

First, the PC board error. Pins 2 and 3 of the CA-3130 mike amplifier (U4) need to be reversed. I cut the PC board traces between pin 2 and the pad on the board next to pin 2. I also cut the trace going to pin 3, next to pin 3. Then I tied a short piece of jumper wire and connected this trace to pin 2. Pin 3 is then connected with a short section of insulated wire to the junction of C-37, R-26 and R9. Remove transformer T1 and attach an electret mike from the same junction to ground. Observe polarity on the mike, positive to the junction/pin 3 jumper. Also, use shielded cable such as RG-174 miniature coax cable or other small-diameter shielded cable. Sorry for the PC board error.

Bug Number 2

The next problem, low sensitivity, can be traced directly to the TDA-7000 circuitry. Though I never had this problem with my own transceiver, it has been reported in several units. Unable to duplicate the problem, I had one of the units returned to me to debug, and finally found the solution. The unit, with a sensitivity of about 200 microvolts for full quieting, was very much in trouble.

Photo B. Monument Peak. WB6IGP's dish looking south. The "golf ball" in the distance on Mt. Laguna is an Air Force radar installation.

Photo C. WA6VLF and W6OYJ next to their 10 GHz systems on Monument Peak, looking north. The desert floor is some 5,000 feet lower in the distance.

Photo A. N6IZW and WB6IGP dishes on top of the rock, part of a group effort of the San Diego Microwave Group last September. The longest QSO for the entire group that day was 415 km. from Monument Peak to KY7B's group south of Prescott, Arizona.

I thought that it was operating on some lower harmonic of 30 MHz, but initial sweep of other responses proved that theory wrong. I checked capacitor values external to the TDA-7000 chip, setting the chip up in one of several bandwidths and operating schemes, and all seemed OK. Placing the chip in my old PC board proved that the chip was OK, with full quieting at about four and a half microvolts. Perplexed, I tried replacing several capacitors—to no avail. Sensitivity was still at 200 microvolts. After quite some time I hit on the answer: The problem was with the oscillator coil!

It was wound as I specified—12 to 13 turns of #24 or so gauge wire. In this unit I had to replace the original coil and rewind it with #20 enamel wire (12 turns). This gauge of wire barely fit on the miniature coil, filling it up to the top of the form. When the power was reapplied, voila—5 microvolts sensitivity.

This seemed like black magic, as the original coil checked out resonant at 30 MHz with my grid dip meter. What was going on? I replaced the coil with the original coil, and low sensitivity resulted, confirming the coil to be the culprit. I have not determined just what is going on, but I suspect that coil "Q" was at error, and did not match the chip circuitry for some reason. Wind your coil with a larger gauge wire, and it should solve the problem.

I have picked up a Hewlett Packard RX-250B ("Q-Meter") capable of measuring impedance at a particular RF frequency. Though I don't have time right now to test my theory, I believe the coil impedance to be at fault. By the way, this HP-RX meter can measure impedance from a few MHz to just over 250 MHz, making a direct readout in resistance (impedance). When I get the test jig finished, I will report the results.

The ability to pick up such an instrument from surplus is attributed to my

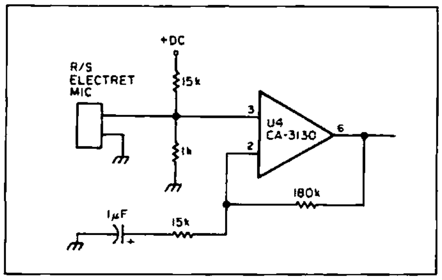


Figure 1. Changes in the mike diagram. Pins 2 and 3 were reversed on the U4-CA3130 op amp.

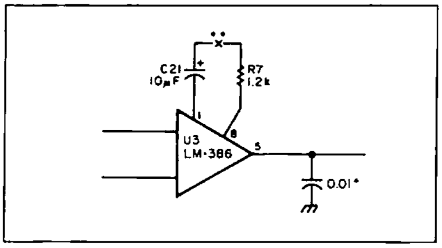


Figure 2. Modifications to audio amplifier LM386: Add a 0.01 µF bypass capacitor, pin 5 to ground.

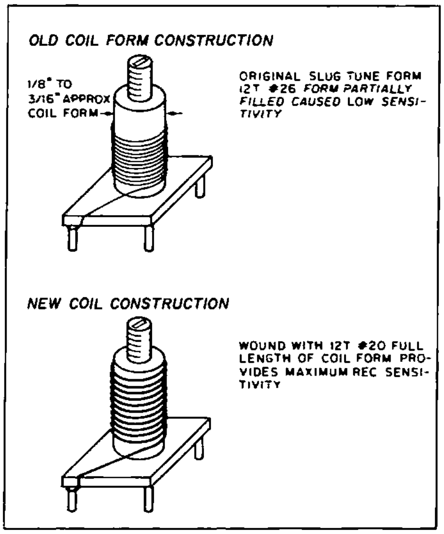


Figure 3. Oscillator coil form modifications.

location here in Southern California, where large surplus materials are disposed of by manufacturing and military contractors. Sometimes you get lucky, too, at a commercial auction and beat a dealer to a choice piece of equipment such as this HP impedance meter.

Bug Number 3

Now for the third and last problem: feedback in the audio circuitry at gain settings near mid-volume range. This is particularly troublesome with systems that use small speakers as part of the cabinet wiring. The rigs that I use are all equipped with a small headset (4 to 8 ohms) similar to Radio Shack's $5 version for small portables. Nothing fancy in a headset is needed here.

The feedback in most units was traced back to the output of the LM386 audio amplifier chip. The original design called for a ferrite bead shunted by a small value resistor to aid in suppression. However, an additional 0.01 µF bypass capacitor with pin 5 to ground will further aid in controlling feedback. I did not use sockets on my PC board, as all chips are soldered directly to the traces. This made for a very short path for the added 0.01 µF capacitor by soldering the capacitor on top of the board from the chip to the ground foil with almost no lead length at all.

Additionally, you should construct the ferrite bead with three turns of wire, and use short leads to connect it to the circuit. Long component leads do a disservice to this type of circuitry, and lead to instability and other problems. For further gain reduction, open up the capacitor and resistor on the LM386 pins 1 or 8. This places the chip in low gain mode.

Trouble-Shooting

To trouble shoot a PC board constructed from scratch, never attempt to look at it as a complete unit. Break it into small sections and test each portion of the circuit as an individual item, not as a complete circuit. If you do try to test the circuit as a whole, it can work, but go back to basics if trouble develops. Always verify voltage supplies first for proper operation.

Check voltage on the power pins and verify ground connections on the chips, such as the grounding on pin 16 of the TDA-7000. Check the audio amplifier, and touch the input with your finger. Can you hear a 60 Hz hum or other noise increase? If so, it's probably OK. Proceed to the TDA-7000, touch the antenna input with your finger, and if you can hear commercial FM broadcast stations, it is functioning. What this chip is responding to is the third harmonic of 30 MHz (assuming the coil is properly resonant or close to frequency).

You have to remember you are dealing with a single chip receiver, and there is no tuned circuit to prevent harmonics from coming through the front end of the system. This problem can be partially eliminated when the preamplifier is connected between the mixer diode of the microwave detector and the receiver input. The preamp is adjusted by the nature of its tuned circuits to provide a passband at 30 MHz, which helps to eliminate this harmonic problem.

In very stubborn cases of commercial FM broadcast interference, you might want to place a 30 MHz low pass filter in the circuit to totally eliminate the problem. Of course, the receiver housing cannot be plastic, since good RF shielding is the key to prevent RF interference from entering the circuits.

Construction tips include some information on the CA-3130 op amp. This op amp cannot be replaced by a conventional 741 op amp as it is a special type of device classified as a "zero offset voltage device." This is a special application for an op amp, in that the device does not require a split or two-voltage power supply to swing output voltages. It is designed by its special circuitry to swing its output voltage from ground potential and positive Vcc. No other chip that I am aware of will allow operation to ground potentials. That's where it gets the term "zero voltage offset." It can operate to ground potentials.

Most all other chips require a voltage offset from the negative rail for proper chip operation. The 741 op amp is typical of this type of offset voltage that is required. This makes circuitry a little more complex to run from a single power supply such as +12 volts and ground. Most circuits use a floating ground, allowing both a positive and negative potential for circuit operation. In comparison, the 3130 requires only a single power supply and ground, since the circuitry inside the chip makes this zero offset and single power supply operation a real boon to simple circuits.

The LM386 was selected for the same reason, a single power supply voltage for its operation. This keeps the parts count at minimum for the audio amplifier. Keep it simple and it's easier to build.

Microwave Brick Update

Confusion on ordering crystals for the 10 GHz brick oscillators for the Frequency West phase-locked oscillators prompt a short note. The oscillators operate on the crystal's 102nd harmonic. For example, assume a 10,368 MHz operating frequency and a 145 MHz IF. That makes the frequency minus IF to be 10,223 MHz for the brick oscillator. Divide that by 102 for the crystal frequency, which equals 100.2254902 MHz.

The multiplication scheme we use in the brick is 17 times the crystal to lock the cavity oscillator. This oscillator is then multiplied six times in a varactor multiplier for an output frequency of 10,223 MHz. Crystals can be ordered from International Crystal Co. and cost about $20 each. The part number is #585132. Specify your brick output frequency, crystal frequency for verification, and the type of brick you have, such as Frequency West type 54XOL.

10 GHz Contest Notes

Our furthest contact during the ARRL 10 GHz contest was 255 miles distant. Ed N6OYJ, Jerry WA6VLF, John WB6BKR, Kerry N6IZW and myself WB6IGP at DM12SV Monument Peak, near San Diego, worked KY7B at DM34TK, south of Prescott, Arizona. We were all very excited about five stations working five DX QSOs between the two states.

The Arizona end was operated by KY7B, WA7YLI, and WA7CJO. Twenty watts and a 30-inch dish was used at the Arizona end. Power on our end ranged from 4 to 8 watts for Kerry and myself with TWT amplifiers and similar dish antennas. N6OYJ, WA6VLF, and WB6BKR all used 0.1 watt! The contact on 10 GHz SSB sounded like a wailing banshee due to the cloud Doppler from thunderstorm activity.

Mail Box

Ward WB7VVD reports laser QSOs over an 18-mile path. He has just picked up a 110 mW Argon laser and is interested in some long-haul laser communications, somewhere in the 200-mile range. Ward is also constructing a 10 GHz SSB system in concert with several other stations in the Phoenix area. The biggest thing stopping construction is 10 GHz mixers. Ward reports that microwave components are not easy to come by in Phoenix.

Dave Pascoe KM3T is also constructing a 10 GHz SSB station. He is looking forward to getting his station running for the upcoming contests as he plans to do some mountain topping very soon. Note: The 10 GHz frequency normally used is 10.368 GHz, or 100 kHz higher in frequency to eliminate multiple station operation. Yes, even on contest weekends QRM on 10 GHz is noticeable.

John DeLong of Vancouver, B.C. picked up several Gunn diodes, and was wondering if I have access to other obscure materials such as Teflon™ PC board material. Yes, John, I have Teflon PC board material, and I use it to construct several different items. One is a dual-stage MGF-1402 amplifier for 10 GHz. I make bare board stock available from material on hand. While I am not a one-stop store, and do not intend to become one, I do stock many different microwave devices and materials such as boards and miniature capacitors. I try to gather microwave materials like a squirrel gathering nuts for the winter. With a great surplus area to wander through, lots of things turn up.

If there is something in particular you are looking for, drop me a line (please include an SASE) or give me a call on the weekends. If I don't have it I might be able to put you in contact with someone who does.

Dave N4JGQ of Falls Church, Virginia, is helping a new ham who is quite interested in 10 GHz WBFM. Dave is constructing two of the IF systems for use with Gunn systems. Douglas NØNAS of St. Paul, Minnesota, is also constructing two IF systems, and he has enough parts to complete the 10 GHz WBFM equipment. He is keeping his eye out at the next swap meet for 70 MHz TV converters. I presume they are for video operation. They should make a great video IF system.

Well that's it for this month. As always, I will be glad to answer your questions on microwave or other VHF/UHF related topics. Please include an SASE for a prompt reply.

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The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

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The RC ol JHS 22 NYC, INC., P.O. Box 1052, New York NY 10002. Round lhe clock HOTLINES: Voice (516) 674–4072, FAX (516) 674–9600. BNB762

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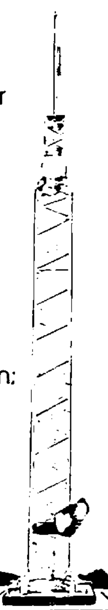

Never Say Die

Continued from page 4

your local schools to talk hamming, you're not doing your bit to revive our moribund hobby, which has turned into a pasture for retired old white American men. It's a nice place for old men to talk to each other without even having to listen. The crackpots can rail against perceived villains. The seriously demented can muster around KV4FZ on 20m. Those interested in hearing endless self-promotional harangues can tune in K1MAN's broadcasts.

A Baited Trap?

The recent FCC's offer to relax our rules so we can order pizza over our repeaters looks so reasonable that I suspect most hams will grab the bait and try to run.

Alas, the bait, as always, has a hook in it. But what about the wording of the offer? There's this bit in there about this helping to use our "excess capacity." Whoa there, Nelly! Yes, we have an incredible amount of excess capacity, but we know how bureaucratic systems work, so if we ever actually admit in public that we have excess capacity, we'll find it up on the chopping block like the two MHz we just lost from our 220 MHz band.

Bureaucracies are essentially socialist systems. There is no profit motive involved. The bureaucracy takes money away from people by force and spends it as it sees fit. When our beloved federal government starts running out of money to spend, they turn to the states for more. When the states start running dry, they increase taxes.

You're well aware of the bureaucratic funding system. Each department gets a yearly budget. This usually is a certain percentage higher than last year's budget. Comes the end of the fiscal year and the department better damned well have spent the full budget, or else they'll get their budget cut for next year. No department ever comes in under budget. No department ever needs less for the next year's budget.

It's the same with our frequencies. We have to spend our budget or we'll lose it. This means that even if we can't possibly use more than 10% of our allocated frequencies, we have to somehow give the impression that we're in terrible shape for the lack of more desperately needed frequencies.

Excess capacity? Once we admit to a bureaucrat that we have anything like that we're fair game. And those of you who still have hinged minds are aware of the pressures the spectrum allocators are under to make room for new communications technologies.

Mobile telephones, complete with fax machines, aren't a surprise to us. And we know full well that we're facing some sort of pocket telephone system. We know we'll be having pocket computers, complete with instant radio communications anywhere in the world.

The electronic giants are looking for under-used capacity. Their pressure has already started to break loose some bands reserved for military use.

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

So here we sit, with multi-megahertz of almost totally unused channels.

Sure, we have pile-ups on 20m when someone in a rare country has the stupidity to come on the air. We drive him off in short order with demands for tens of thousands of QSLs, all in the name of international goodwill. That's a laugh. I've sat and talked with hams in over a hundred countries and in case you don't know it, American hams are an international joke. We're considered to be the worst operators in the world.

American DXers have worked arrogantly and inconsiderately hard to achieve this world recognition. Maybe we need something more than an obscure *QST* Honor Roll listing as a reward.

While we have several thousand virtually unused repeaters and wide-open UHF bands, we're sitting ducks. More hams would help. And not admitting to excess capacity will certainly help.

The FCC Auctions

More and more readers are sending me clippings about the FCC's plans to auction off unused or sparsely used segments of the spectrum . . . wondering if "sparsely" means us. It certainly could. I think our use of our most valuable bands could easily come under that definition.

By most valuable I mean the 99% of our spectrum we're not using at all, not the 1% we're just barely using . . . or misusing.

Am I referring to 20m? No, I think any rational jury in the world would uphold our use of this band. What possible fault could they have found with our DX pile-ups, list operations, the wiping out of half the band by DXpeditions with no intelligent operators, the melee on 14.313 or K1MAN's endless self-promotions on 14.275? No, I think that band is safe.

And two meters is certainly being fully used. One only has to look at any repeater directory to see how full that band is . . . packed solid with almost totally unused repeaters self-identifying now and then.

One percent of our 1296 MHz band was busy the other night during the moonbounce contest. It gets busy once or twice a year for a few hours. That ought to hold the band, right? Bill Brown WB8ELK and I were going to listen to the fun via our Hancock Very Long Base Array dish just down the road, but the tilting motor had burned out.

I'm encouraged to get newspaper and trade magazine clippings because it shows there are at least a few hams who are beginning to become concerned about keeping our bands. And I thought no one cared!

The old "use 'em or lose 'em" warning holds to some degree. But that isn't everything. It also counts *how* we use 'em. There's a 2m repeater in L.A. that's so incredibly bad it made the front page of the local papers. That isn't likely to count heavily toward extending our lease. Nor are our increasing complaints, aggravating both the FCC and Congress, concerning problems we should be resolving by ourselves.

So what can we do about it? I've suggested in the past that you get the ARRL to dedicate a department to working with the members to clean up our bands. Just as businesses are having to attend to quality problems with their products and services, if we continue to be unconcerned about the perception that we are wasting valuable spectrum, we're eventually going to lose it.

It's difficult to get any hints yet as to whether we might just lose everything all at once, or whether we may see our bands frittered away through misuse and disuse. I hate to see us gambling with a hobby which has such a potential value to both our country and the world.

Since the ARRL is our *only* national ham organization, the responsibility for the health and welfare of the hobby would seem to fall on their shoulders. So yes, I'm critical of their refusal to accept this responsibility.

We need two major changes in the ARRL. One would be for the directors to establish a quality control department to help clean up our bands, and the other would be to set up a department dedicated to achieving ham growth. Lacking these basics I'll continue to carp.

Meanwhile, my sources deep within the FCC are leaking disturbing news. Our stock is not high in Washington. The suitors for our bands are well-heeled and spending where it counts. We're countering this spending offensive with bitching and complaints. Apparently the not exactly new concept that in Washington money talks loud and clear has yet to perk through to most ham minds.

Our License Exams Stink

Do you know why old-timers go into a total panic when anyone mentions retesting? Do you know why, when the ARRL proposed what they amusingly called "Incentive Licensing" in 1963, that it totally stopped our growth and tens of thousands of hams sold their stations for anything they could get for them? The panic put over 750 ham stores out of business in one year and killed off virtually every major ham manufacturer within two years.

It's the same basic problem which has poisoned our entire educational system and is helping to make America less and less competitive in the world.

There are two basic ways of learning: rote and cognitive. With one you memorize data so you can parrot it back later to pass a test. With the other you understand the concept so you don't have to memorize anything.

Our ham exams are designed to test memorized information, not concepts. So, in order to pass them, we sit down with a Q&A manual and memorize. This works fine if you take the test while the memories are fresh. But memorized information evaporates quickly . . . and it's gone.

Just think of how many years you wasted in school memorizing crapola just so you could pass all those stupid tests. You know you could never pass the same test a month later without re-memorizing the stuff all over.

I've got a good memory for things I enjoy. I can still recite poetry I learned 60 years ago and remember the words of the songs I've learned over the years . . . even those in foreign languages I don't understand.

But when it comes to things which aren't fun, my memory, like yours, is painfully short. For instance, I had a terrible time in high school. I needed three years of a foreign language to get into college so I started French in my freshman year. My mind rebelled. Every time I'd sit down to do my vocabulary memorization homework I'd fall asleep. My folks tried a tutor, but I still fell asleep. It took me four years and a summer school session just to pass three lousy years of French . . . and I still couldn't speak it.

They forced us to memorize the grammar rules and vocabulary, not how to actually use it. And that's what so much of high school was like . . . awful. History memorization. Geography, math, English literature . . . all almost 100% memorization . . . and pffft.

College, alas, wasn't any better.

Their English literature course required us to memorize the authors, the dates, titles and short synopses of about 300 Victorian novels. Calculus was worse, with hundreds of formulas to memorize. The "teacher" got mad when I asked him where we might find a use for all this in real life. He didn't know.

I found out how bad it was when, after spending four years in the Navy during WWII, and managing by several flukes not to get killed, I went back to finish my last two years of college. I'd passed two years of calculus and had one last course to go. But when I got back I found I had zero recollection of the first two years. I had to spend a whole lousy summer re-doing all of it again and none of it seemed even vaguely familiar.

Most of my college courses called for memorizing data just long enough to pass a test. I knew I hated this and was frustrated at the waste of my time, but I was too dumb to get the hell out of there and stop. I'd been brainwashed on the importance of a college degree. You know, no one hiring me has ever even asked about it.

I should have figured it out when I went through the Navy electronics course. That was incredibly good. No memorization involved. I know it's unbelievable that the military could ever do anything right, but they sure did... at least once.

We'd sit in a chalk-and-talk lecture to learn how something worked. Then we'd go into a lab to use what we'd just learned. For instance, they explained to us how a superheterodyne receiver works, circuit by circuit. Then we'd have to fix a bunch of fiendishly disabled receivers. We had to understand how they worked to figure out what they'd done to them.

That school was so good they were teaching kids who didn't know a volt from an ohm how to fix anything electronic in just nine months. I learned a hundred times as much in nine months there as I did in four years of college.

Right now I'm working in my sneaky way to try and change the American educational system...to get it to dump memorization and go for cognitive teaching.

Meanwhile, how can we go about changing our ridiculous ham exam system to something better? I have in mind a cognitive system with no written exam at all.

If we could do that and assure that newcomers had some understanding of radio, I'd be able to go back to publishing technical articles in *73*. But with about 50% of the readers still not sure about transistors and yearning for more tube equipment, the call for digital voice communications and digital signal processing articles is faint. Yet that's either where we're going to head, or we're going to be blown away.

Oh, I don't mind a couple of old fa...-timers...using AM on 75m. Maybe on one frequency. But I do take exception to their trying to lure others into their folly. Other than as a museum exhibit, AM should be dead. Old-timers can testify about how long it took after CW was invented before spark was finally eliminated. The FCC had to outlaw it to get 'em to stop. "Spark Forever" was the cry. So what's changed?

SSB is the spark of the 1990s. We're pathetically behind in technology, but we're making up for it by making sure that newcomers haven't a clue as to how radios actually work.

Well, I may not be able to convince anyone of the need to change our really dumb ham exams...you know, the ones which didn't keep out KV4FZ and K1MAN...but I will be trying to get New Hampshire to take a leading role in promoting conceptual teaching instead of memorization. Thank heavens we're a small state, so it's not difficult to be heard.

The New Ham Exam

Okay, if memorization for our tests has screwed up the hobby, what could we do instead? How can we go about teaching concepts? Well, I went this route in the Novice license study guide I put out around 25 years ago. Then came Bash saying hey, take the easy way, I'll help you memorize the answers to the tests so you can pass it with one weekend of work. He even helped thousands get Extra Class licenses without having to bother learning the code.

I like the idea of all newcomers being taught the concepts of radio by local ham clubs. They'd also teach 'em how to get on the air and make contacts. It would be a combination of teaching and apprenticeship. Then the club, once they're sure the newcomer knows enough, would issue a license. The club would continue to be responsible for the hams they accredited.

Thus, someone like K1MAN would have to answer to his peers when he started causing trouble...and the club would be able to suspend his ticket if he refused to behave. Yes, he'd probably sue. I'd ask for a rule which would suspend the license of any ham bringing a ham-related suit...until the legal action has been completely terminated. That would stop a lot of expensive nonsense.

Contributing Engineers

A letter from Don Lively W6SJQ had a great idea to help our educational system start teaching technology and math. Presuming that this isn't the first of my editorials you've ever read, and that you are not part of the 50% of the American public which reads no books or magazines at all, and that you've also isolated yourself from radio and TV, it will not come as a major surprise to you that our country is a tad behind on generating new engineers.

I claim that amateur radio is mainly to blame for this disaster. If amateur radio had kept growing at the rate it did from 1945–1963, at 11% per year, we'd today have 3.5 million licensed amateurs...about double those in Japan, which has half our population.

Further, we'd be generating about 385,000 new licensees this year. In the pre-1963 period 80% of these new hams were youngsters (300,000) and 80% of those (240,000) would be going on into high-tech careers as engineers, technicians, and scientists. And we would have already contributed 2.25 million high-tech careerists in that period.

My plan for getting kids started learning the fundamentals of electronics, communications and computers via peer-teaching grades 5–12 in our schools, and forming radio, computer and experimenters clubs should do it. I suggested that local ham clubs would be glad to lend a hand in answering questions for the classes. Ditto local computer clubs...and there are some big ones around.

The Boston Computer Society is humongous, complete with a very active ham special interest group. I know they'd jump to help any school within driving distance.

Don suggested a mother lode of available high-tech volunteers...the Ma Bell retirees. With Ma slimming down, like other big businesses, she's turning out thousands of early retirees. This is a great resource for teaching help.

Some states are so tightly controlled by the teachers' unions that it's illegal to let a qualified technical person come in and teach. That's ridiculous, so I hope you'll put on the pressure with your state legislature for a change. The teacher and state employee unions are particularly powerful on state levels, so it's going to take some strong parent group action to break their power hold.

New Hampshire permits alternative teachers, so it can be done here... even though we have a corker of a teachers' union.

Between volunteer hams and retirees, we should be able to help youngsters cope with technology...at least the basics. I don't think hams will be too helpful in explaining in simple language how telephone switches, facsimile, computers, and other modern conveniences work. But, unless they've Bashed their way into a license, they should be able to help teach electronic basics.

A New Hampshire Opportunity

The recession has hit New Hampshire particularly hard. I've watched For Sale signs going up everywhere and home prices drop like a rock. It's just about decimated the banks. In fact, the situation got so bad that the legislature decided it was getting time to try and do something about it.

They consulted themselves first. But they didn't know what to do, so they voted to put together an Economic Development Commission, with members from both industry and government, and have them appointed by the legislature and the governor. I know this is going to aggravate the hell out of my detractors, but I was one of the five appointed by the governor.

The goal of the Commission is to provide the legislature with a plan to tackle the short, medium, and long term problems facing our state. This is just the opportunity I'd been waiting for, so I could hardly wait to get started.

The Commission has some real strength. In addition to a couple senators and some legislators, we have the president of the University of New Hampshire, and a number of successful businessmen.

So why am I bothering you with all this, other than blowing my horn again? Because it's a fantastic opportunity for amateur radio to not just achieve record growth, but to nail down our hold on our bands just at a time when we're in serious danger of losing them.

Oh pshaw, you say...or something less printable. How can amateur radio help pull New Hampshire out of a recession? If you said that, then you either have a terrible memory or you haven't been reading my editorials for the last 40 years. Even worse, you may not even see how this opportunity up here in New Hampshire might easily be translated to your own state to help it cope with the world of 2002...which is only 10 years away!

That reminds me, I'm getting really pissed at King Hussein for frittering away his time with all this hostility baloney when he should be gearing his people to be successfully competitive in the future. I haven't seen one hint that he's been planning for 10 and 20 years from now...and that's the mark of a good manager.

Is your state busy coping with immediate problems and losing sight of the future? That's what happened in New Hampshire and I don't think we're unique.

The Immediate Problem

New Hampshire has suffered more than most other states in this recession because such a high percentage of its jobs were in generation-old high-tech industries which were bound to collapse...and now are in the process of doing that.

Massachusetts-based minicomputer companies such as DEC, Data General, and Wang expanded into New Hampshire and became major employers. As I've pointed out in past editorials, the minicomputer industry is, like the mainframe computer industry, doomed by the microcomputer. This technological revolution will also eventually bring down IBM. It's the disintegration of these giant firms which has made New Hampshire suffer more than most other states.

The minicomputer firms arrogantly ignored microcomputers and are now paying the price. They are no longer competitive against computer systems which cost one-tenth as much for the same performance.

I have some fast fixes for the hole the collapse of these minicomputer firms has made in the New Hampshire economy, but in the longer range I'm recommending a fix which should be adopted by every state in the union, as well as other countries. It's a shame that bad planning on a state level has brought this about. I warned Governor Sununu that this was an inevitable result of our dependence on these huge firms.

In the short term I have a proposal which I believe will turn our economy around within two years. As an entrepreneur I tend to think in terms of self-financing changes, so my recommendations will call for a small venture capital investment up front. . . either from the state or from private sources, backed by the state. But it should be able to repay the investment within three years and make a nice profit from then on.

If you're interested in my reports to the Commission in detail, I'll put them on our BBS as I write them. I've only written about 50 printed pages so far, but I've a lot of material yet to be covered.

Now let's get to where amateur radio is going to save the bacon for New Hampshire. . . and maybe America, and then the world. And I'll get to how you can participate, helping to make this happen.

If you're living in a relatively small state such as New Hampshire, you'll be able to have more of an influence than if you're in a big state. That's one nice aspect of living in New Hampshire: It's small and it has a citizen legislature (the largest in the country), so it's not at all difficult to know the top people. I've been good friends with several governors and senators. Heck, my grandfather was a state senator.

The Problem

In the long run New Hampshire (and any other state) is going to be successful if it can attract high-tech businesses. . . preferably smaller entrepreneurial high-tech businesses.

The day when low or unskilled workers can survive is passing. The day when a state's economy can depend on low-tech manufacturing. . . or even manufacturing of any kind, for that matter, is passing. Transportation and communications costs have dropped, making it so workers in other countries are almost in direct competition with ours.

It's so easy to make things over the border in Mexico, at a fraction of our low-skilled wages, that production will be forced in that direction. . . and to the Philippines where 15¢ an hour is a good wage. Or to China where slave labor costs far less than that.

This means that the work force of 2002 is going to have to work smarter rather than harder. And that, in turn, means that we're going to have to make some major changes in our educational system. We're shortchanging our kids with an antiquated system. We're not teaching them math and science, even though we know full well that if we don't we're going to be sentencing them to failure.

Our educational system is heavily entrenched and has been able to resist every effort so far to make substantial changes. In a recent address to the largest chamber of commerce in New Hampshire, Governor Gregg explained that the teachers' union is one of the most powerful lobbying forces in our state.

Okay, we want a high-tech oriented and educated work force by 2002 so we'll be able to attract high-tech firms to the state. That means we've got to make some major changes in our whole educational system within the next year! We haven't got time to horse around.

But, whine the educators, we don't have the math and science teachers we'll need and it'll take at least 10 years to develop and accredit them to teach. That's only if we agree to go along with the present system. I'm proposing what's called a paradigm shift. . . going about this a whole new way.

I'm proposing that we start next fall with an eight-year course in the fundamentals of electronics, communications and computers, all taught via a weekly publication much like *Radio Fun*, which guess who would publish. The kids would get together every day in groups and discuss the material with each other. This is called peer-teaching and it's worked fabulously in a few trials.

To help these peer groups we'd make available consultants for them to invite in from the business and retirement community.

This weekly publication would, in addition to having the week's study material, also have columns encouraging kids to form school radio, computer, and electronic experimenter clubs. The key to getting them to learn would be to make it fun. The clubs would make it even more fun.

Since we have hams in every part of the state, we'd be able to enlist many of them as volunteer consultants for these classes. Plus, we'd be able to draw upon computer groups and high-tech retirees.

By making learning fun for a change, we can not only generate thousands of high-tech career workers for 2002 but, I believe, also get amateur radio into high gear for the first time in almost 30 years. With a bunch of kids coming along, anxious to experiment with our almost unused microwave bands, and eager to start using digital voice on our lower bands, we're a lot less liable to lose our frequencies.

Will I be able to sell the idea to the Commission and then to the legislature over the resistance of the NEA? We'll see. Surely at least one ham must be in a position to try and get a similar movement going in another state.

If we can fix our short-term problems quickly and then lay the groundwork for a future high-tech work force, we're going to have to fight off newcomers to the state. We have the lowest taxes in the country right now. And, despite our problems, we've been rated the "most liveable state." There certainly isn't a more beautiful state, nor one with more opportunities. And we attract vacationers in spring, summer, fall, and winter. Indeed, tourism is our largest industry.

Just as amateur radio has fallen behind in technology, New Hampshire bet the farm on minicomputers and is paying the price. The microcomputer publishing center I built in Peterborough provided an incredible opportunity, but instead of building on this strength, the town made it almost impossible for new entrepreneurial businesses to get started. Now Peterborough is paying a particularly heavy price. ■

Random Output

Continued from page 84

forget about it for the rest of the day? Do you provide snacks for breakfast and sandwiches for lunch? If not, have you recruited volunteers to visit the booths and take lunch orders? Many hamfests get the local Girl Scout troop to provide this lunch delivery service. The sight of those young ladies bringing you a cold drink after you've been standing and talking for five hours without even a bathroom break warms the heart of even the most disgruntled exhibitor.

Be A Good Business

Let's face it: Hamfests are big business. The same rules that apply to running a good business apply to running a good hamfest. Treat your customers like the important people they are, and they will return. Treat them like you are doing them a favor, and you will eventually go out of business. A hamfest's prime customers are the exhibitors—not the attendees.

A company spends thousands of dollars to attend your show. Retailers hope to make that back in sales at the show. A manufacturer or a company like *73* attends a show for the PR and customer relations value. Even if the hamfest is badly run, the retailer will return if he makes money. Not so with your other exhibitors. If the hamfest organizers are rude, inconsiderate, inconvenient and have bad attitudes, most of the exhibitors will eventually stop attending that show. There are hundreds of hamfests every year and we can only attend so many. If your show isn't the best—from the exhibitor's view—then we will simply attend a different show.

The Best

So. . . you may be wondering where the good and bad hamfests are. Since I'm in a particularly magnanimous mood this month, I will refrain from naming this year's worst hamfest. (It's too bad. It was my first time in that particular city, and I really liked the area, but the hamfest was so badly organized—and the organizers were so untruthful, uncaring and unbusinesslike—*73* will never again be seen at that particular gathering.)

As for the best, the hands-down winner is the Houston Com-Vention. The folks running that show, especially Richard Shankle, are pros at putting on a hamfest. They treat the exhibitors like gold, and the people in Houston are chock full of that famous Texas hospitality. Houston is nowhere near the biggest hamfest of the year, but Richard and the entire crew made us feel so welcome, and were willing to do anything to make our jobs as exhibitors easier, that I can guarantee you that *73* will return next year. Every once in a while, during setup and each day of the show, someone would come by our booth to see if we needed anything. I think I was asked at least a dozen times, "What can we do to make this hamfest better?" Congratulations to everyone involved with the Houston Com-Vention. You all did a great job.

Come to think of it, the Dallas Ham-Com was a close second. Maybe it has something to do with Texas. ■

Number 28 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

How To Have A Hamfest

As I write this, the hamfest "season" has wound down. As you read this, the new season is just about to begin. While there are companies that go to many more hamfests than *73* does, we have visited about 15 or 16 conventions over the past year or so.

One of the after-hours activities of the exhibitors is talking about how good or bad the various hamfests are. Putting on a good hamfest isn't difficult, but you'd be amazed at how bad some of these shows are. After numerous conversations with representatives from large and small companies, I would like to offer a few suggestions—through the eyes of the exhibitors—to those who are responsible for putting on hamfests.

Attitude

The fundamental problem at the root of all bad hamfests is attitude. With very few exceptions, most hamfest organizers have a basic attitude problem. They treat the exhibitors as an afterthought—as if we exhibitors should feel beholden to the event organizers for allowing us to show up and set up a booth. Though this attitude is never put blatantly into words, it is evident in the way many hamfest committees treat the exhibitors. They have forgotten that without the exhibitors there IS no hamfest. The money exhibitors pay for booth space is what makes the hamfest possible. The audience attracted by a good number of exhibitors is the lifeblood of an annual hamfest.

You would think that this would be simple common sense: Treat your exhibitors well, and your hamfest will prosper. You'd be surprised at how many hamfest organizers forget this basic fact.

Don't Lie

Treating the exhibitor right begins with telling the truth. Don't inflate your previous or expected attendance figures in the mistaken assumption that we won't notice. If you tell me that you expect 5,000, and only 2,000 show up, it will be very difficult for me to believe you next year, when you want my business again. Be honest. Even better, be conservative. If you expect 2,500, tell me you plan on 2,000. That way, when your actual attendance exceeds your projections, exhibitors will be pleasantly surprised instead of hopelessly disappointed.

Whether or not *73* attends a hamfest is a basic business decision. While that decision is based on many factors unrelated to the particular hamfest (schedule, budget, personnel), a large part of that decision is based on information provided by the hamfest organizers. If you give me the most accurate and honest information you can, I can make an informed business decision. If you lie to me, you will probably never see the *73* booth at your hamfest again.

Be Convenient

The job of a smart hamfest organizer is to make it as easy as possible for the exhibitors to attend. The less hassle I have to go through to attend your show, the more likely I will be to leave with a positive opinion of your efforts.

Convenience begins with things like where the show is held. Is it convenient to the airport, or will I have to drive for an hour to get there? Is the convention hall in or near the hotel, or will I have to drive there? If the convention is not in or next to the hotel, is there convenient "exhibitors only" parking at the convention sight? If I have to fight through a traffic jam to get to the parking lot, then fight for a parking space half a mile from the convention center, you have not been thinking about the convenience of your exhibitors.

Most hamfests run all day on Saturday and until mid-afternoon on Sunday. In order to be out of the office for as little time as possible, the vast majority of exhibitors will travel on Friday. If Friday night set-up time ends at 5:00 or 6:00, I either have to fight it out with the guy at the door to let me in to set up, or I have to get up very early in the morning to set up before the doors open on Saturday. You should arrange it so that Friday night setup runs until at least 8:00 or 9:00. There should be hamfest staff there to help with any problems, distribute exhibitor passes, etc. If you make me conform to your "rules" instead of bending over backwards to make it easy for me to attend your show, you have the wrong attitude and you're not making it convenient.

Is it really necessary to open the doors to the public at 7:00 a.m. on Saturday? Most hamfests run 9 to 5 on Saturday and 9 or 10 'til early afternoon (1 to 3) on Sundays. Remember . . . the exhibitors have spent all day Friday in airports, have arrived in a place they're unfamiliar with, have spent a few hours setting up their booths and have probably had a bad meal and little sleep. They will get up Saturday and spend a minimum of eight hours on their feet. Nine o'clock is plenty early enough to open the doors to the public. Any earlier and you are not being kind to your exhibitors.

Be Thoughtful

Few hamfest organizers take the time to think about how expensive and exhausting it is for a company to attend their show. Have you provided a convenient and comfortable exhibitors' lounge? Have you supplied plenty of coffee and soft drinks? Have you assigned someone to check the exhibitor's lounge every 30 minutes or so, or are you just going to put a cooler and coffee pot in there at 8:00 a.m. and

Continued on page 83

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
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Payson AZ 85541

This January will resemble every other January during the upper portion of the sunspot cycle. Early darkness combined with the winter solstice in the Northern Hemisphere will cause the higher DX bands (20 through 10) to close around sunset, with the highest bands going out first. On Good ("G" on the calendar) days, 20 and 17 meters will stay open later. But remember, we are on the down side of the cycle now, and conditions in general will be deteriorating rather than improving with each year.

The best days to look for Good ("G") conditions will be the 1st through the 5th; the 13th and 14th; and the 20th and 22nd.

The Poor ("P") days will be the 17th, 18th, 25th, 29th, and 30th—give or take a day or so.

The remainder of the days will exhibit Fair ("F") DX conditions, meaning that you will have to work harder and listen deeper into the noise to work the weak ones.

There is one very good feature of January propagation: Quiet band conditions where atmospheric QRN will be at a minimum, and the "weak" ones will be audible.

You can expect excellent DX on 160 through 30 meters during the hours of darkness on the days designated as Good ("G") and Fair ("F"). As always, be particularly alert during the twilight hours, around sunset and sunrise, when grayline signals will propagate along the terminator—the line between darkness and daylight around the earth.

You can also watch for an annular eclipse of the sun, in which the sun will appear as a dark center with a bright halo of light surrounding it. This will occur on January 4/5, 1992. The best locations for observing the eclipse will be east of Indonesia and south of New Guinea: Australia, New Zealand, part of Antarctica, Polynesia, and the west coast of North America. These locations don't really affect most of us up here in the northern latitudes, but our foreign readers in Southeast Asia and the Southwest Pacific will be favored.

As we move toward February and March, the bands will improve again for DX, so don't give up. Just make the best use you can of the charts. Check WWV frequently for updates at 18 minutes after any hour, and be alert for sudden changes in the A and K indices, and the solar flux. Magnetic storms could occur on or near the days marked Poor ("P"). See you next month. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
ARGENTINA	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20/40(1)	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
ENGLAND	20	20	20/40	—	—	—	—	15/17	15/17	—	15/17	20
HAWAII	15/17	15/17	20	20	20	20	20	—	—	—	—	10/12
INDIA	20(1)	20(1)	—	20(1)	20(1)	—	—	—	—	—	—	15/17(1)
JAPAN	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
MEXICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
PHILIPPINES	—	—	20	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
SOUTH AFRICA	—	40(1)	20	20	20	—	—	15/17	15/17	20	—	—
U.S.S.R.	20	20/40	20/40	—	—	—	—	—	—	15/17	15/17	20
WEST COAST	15/17	15/17	80/160	80/160	40	40	40	—	20	15/17	15/17	15/17

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
ARGENTINA	15/17	15/17	20	—	—	20(1)	—	—	—	—	15/17	15/17
AUSTRALIA	15/17	15/17	—	20	20	—	20	—	—	—	15/17(1)	15/17(1)
CANAL ZONE	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
ENGLAND	20	20	—	—	—	20(1)	—	—	—	—	15/17(1)	15/17(1)
HAWAII	—	—	20	20	20/40	—	20	—	15/17	15/17	15/17	10/12(1)
INDIA	15/17(1)	20(1)	—	—	—	20(1)	20(1)	—	—	—	—	15/17(1)
JAPAN	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
MEXICO	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
PHILIPPINES	15/17(1)	—	20(1)	—	—	—	20(1)	20(1)	—	—	—	—
PUERTO RICO	15/17	20	20	20	—	20	20	20	15/17	10/12(1)	10/12	10/12
SOUTH AFRICA	—	—	20/40(1)	20(1)	—	—	—	15/17(1)	15/17(1)	20(1)	—	—
U.S.S.R.	20	20	20	20	—	20(1)	—	—	15/17(1)	15/17(1)	15/17(1)	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
ARGENTINA	10/12	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12
AUSTRALIA	10/12(1)	15/17	15/17	20	20	20/40	20/40	20	—	—	—	10/12(1)
CANAL ZONE	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
ENGLAND	20	20	20	20	—	20(1)	—	15/17(1)	15/17(1)	—	—	20
HAWAII	10/12(1)	15/17	20	20	40	40	20	20	—	15/17	10/12(1)	10/12(1)
INDIA	—	15/17(1)	15/17(1)	—	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—
JAPAN	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
MEXICO	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
PHILIPPINES	—	15/17(1)	15/17(1)	—	—	20	20	20	15/17(1)	—	—	—
PUERTO RICO	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
SOUTH AFRICA	—	—	—	20(1)	—	—	—	20(1)	15/17(1)	15/17(1)	—	—
U.S.S.R.	20	20(1)	20(1)	20(1)	—	—	—	—	—	—	—	20
EAST COAST	15/17	15/17	40/80	40/80	40	40	40	—	20	15/17	15/17	15/17

Notes: (1) Possible but rare dual bands (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

JANUARY 1992

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G	4 G
5 G–F	6 F	7 F	8 F	9 F	10 F	11 F
12 F	13 F–G	14 G–F	15 F	16 F–P	17 P	18 P
19 P–F	20 F–G	21 G	22 G–F	23 F	24 F–P	25 P
26 P–F	27 F	28 F–P	29 P	30 P	31 P–F	

73 Amateur Radio Today

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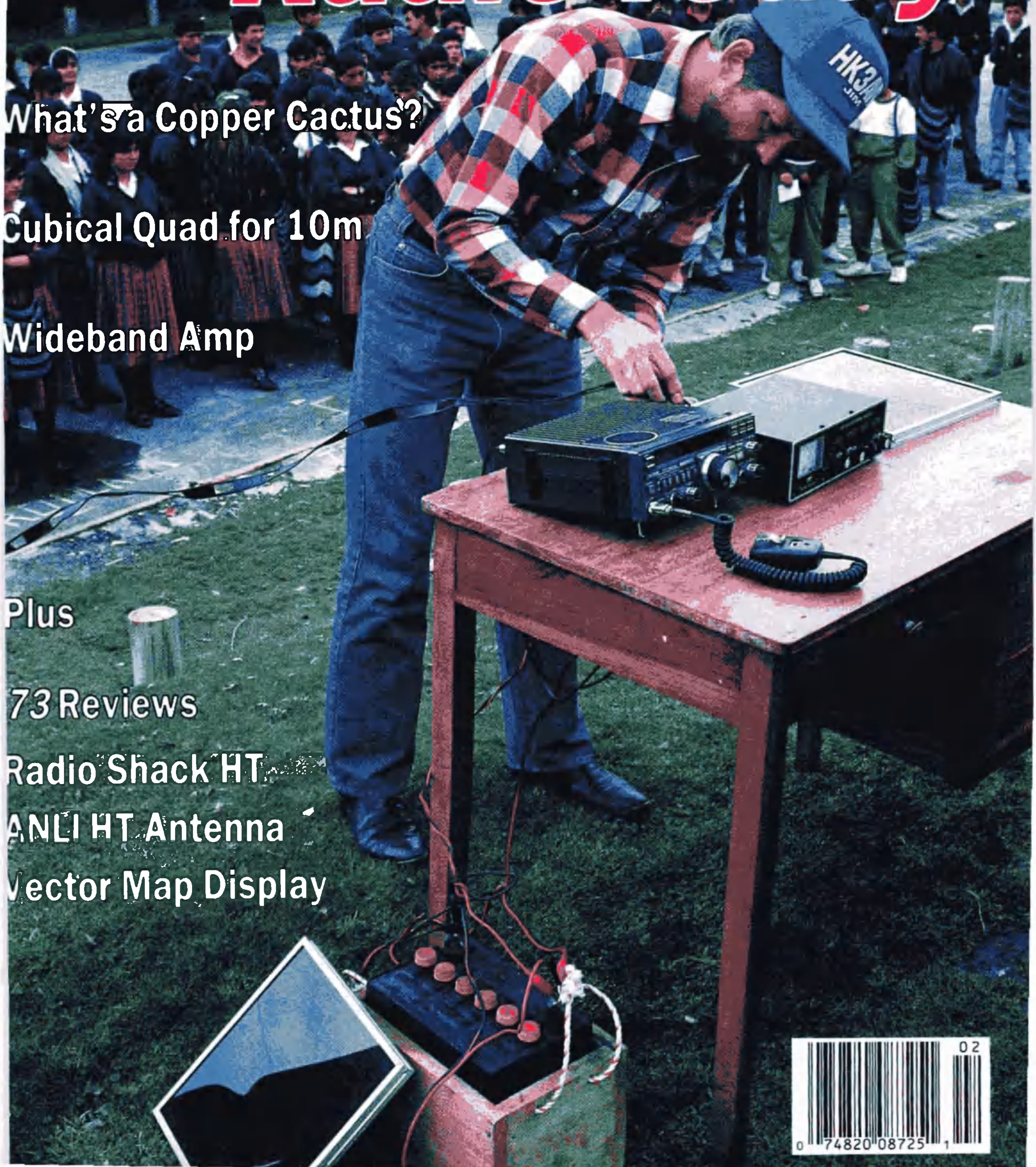


What's a Copper Cactus?

Cubical Quad for 10m

Wideband Amp

Plus

73 Reviews

Radio Shack HT

ANLI HT Antenna

Vector Map Display

LETTERS

Number 1 on your Feedback card

From the Hamshack

Pablo Estrada KD4DGT, Prodigy E-mail Hello! I have been reading *73 Magazine* for about one year now. I really enjoy your magazine and editorial. At age 12 I passed the Novice test and received my license. Unfortunately, I haven't been able to get my rig yet. However, I was lucky to win a computer at a hamfest. I am now trying to sell off my old computer to buy the rig (I already have some money saved up). I live close to a major amateur radio dealer, EEB, which you may have heard of. I really enjoy all the construction articles featured in *73*, and the numerous columns packed in it. I also enjoy the occasional stories on a ham's experiences.

Congratulations! When you get on 20m, let's set up a schedule and talk. Also, you might send a picture in. Wayne

G. Eric Ferguson KA6USJ, Concord CA I'm responding to a letter in the November *73 Magazine*. I am pleased to say that the Commodore 64 is anything but an orphan. Hardware, software, repair and support are easily available for this fine machine, and I would share the following with you:

Commodore Hayward User Group (CHUG): Box 404, Fremont CA 94537. The current president is Dale Gittings, and I'm certain he will help you find support for the C-64. Home-Spun Software, Box 1064-BB, Estero FL 33928 has a number of C-64 ham radio programs for reasonable prices. *[Editorial note: The writer includes a directory printout of two disks of C-64 software he has. He says he will provide a double-sided disk for $2.00 postpaid, and answer any questions about applications that he is able to. Be sure to send an SASE for other information. The address is 2402 Carter Ave., Cody WY 82414.]*

Ted Myren VE3OTQ I'm 21 years old and studying to become a police officer. Up until about two years ago, I was what you would call a punk rocker. I've always had an interest in electronics, but the code usually scared me away from any radio activity. Finally, in 1990 the DOC passed the no-code "basic" license. This let me on the air, any mode, above 30 MHz. I passed my test with no help from anyone except books. Ten minutes after I passed, the inspector told me of a ham course that was to start the following Tuesday. Oh, well. I took the course anyway. After all, a little extra knowledge never hurts. That was last April. Now, after dozens of QSOs, I'm ready to move up to the code requirement. Like a friend of mine said, "The basic license is a license to learn."

I like your editorials, not only because they're true, but because they piss off so many people. I love it! People should show courtesy as well as be more active, and you nag at them for it.... I know how you dislike people giving only a weather and signal report. One thing I learned in college is that everybody is an egomaniac to some degree. If all else fails, ask questions about the other person. I have found most hams will talk about themselves all night if you ask the right questions.

Even though I'm fairly new to the game, I'd like to be active with elementary schools. Sault Ste. Marie has some of the friendliest, people who'll do a lot for a cause. Maybe you could publish an article that would aid hams teaching school kids. What do kids like to see and hear—ATV, DX, autopatch phone calls? My ultimate goal would be to launch an ATV balloon and hook it up so the kids could watch it in the classroom.

Another thing for the young and hopelessly wild: new radio design. Talk to your friends at ICOM, Kenwood, etc., and get some camouflage handhelds, or hot pink rubber duckies. Maybe follow the Sony sports line with yellow waterproof portables. Gray and black are nice, but promote brain death. I want a zebra-striped handheld with a ducky that looks like a snake standing out straight! Psychedelic gear I'm afraid would kill most purists. And we'll never see a mobile whip on a surfboard.

Ted, we publish a monthly column with this focus. It's called "Hams with Class."—Ed.

Bill Ewald Just got the latest issue, and the editorial again takes up more space than any other article. Seems to me that my subscription goes to support your soapbox diatribes more than good writing about the hobby. My subscription will not be renewed, if that makes any difference. Your attacks on the ARRL are not credible. Your verbal meanderings are meaningless. Your position can be distilled down to one theme: The world does not conform to Wayne's view. Well, from what I've read in other BBSs and heard on the air, folks have stopped reading "Never Say Die" even for its entertainment value. Do your readers a favor, Wayne, and give up some of that space for some good writing.

Thanks for the minority report. As soon as the reader evaluations of my editorials go down, I'll find better things to do. Meanwhile, the positive letters are outnumbering the negative at around 20:1. It's almost enough to make a person think.

My meanderings are aimed at double-digit IQs and above, so apparently you have a problem. The world has done a fair job of conforming to my views...in cellular radio, microcomputers, and CDs so far. I think I'll keep going.

Be glad you're not in New Hampshire where I've been named by the governor to the Economic Development Commission. I'm going to make some major changes in the state. Wayne

Larry Chrisman K9OXX After many years, I finally decided to take the easy way out, no more hunting parking places and making empty trips to the newsstand to find the latest issue of *73 Magazine*. Please start my subscription.

Wayne is right, guys and gals. We're going to lose our frequencies. If you don't believe me, just look around at the next hamfest you attend. How many youngsters do you see? At the last two I attended, I would guess that approximately 20% were retired, and less than 10% were youngsters at high school age or younger. Since it appears that the majority of us are old-timers, it looks to me like we are going to die off faster than we are going to be replaced. And as we get fewer and fewer, by what means can we justify keeping our frequencies? About 20 years ago, Wayne stated we would lose 220, and we did. Which will be the next band we lose? Has anyone noticed that the price of cellular phones isn't much more than a 144 or 432 handheld? I would like to see an article on conversion of a unit to our 902 MHz band, or how can we set one of these units up as a cellular repeater system?

I have been reading your editorials almost from the first issue. I haven't read every one, but have read a great many of them. Haven't agreed with all of them either. But keep them coming.

Charles Edward Painter, Oklahoma City OK I have fond memories of my SWLing as a young teen, and recall the many nights I spent listening to hams on my Hallicrafters SX-101A. I felt in those days, approximately 20 years ago, that amateur radio operators epitomized the definition of hobbyist. I recall how courteous and professional the amateurs seemed to me, and I was impressed with their pride in the amateur radio hobby.

In January 1991, I re-entered the SWLing hobby (after an 18-year absence) and thought, at the time, that possibly I would go forward and obtain my Novice ticket. However, the afternoon of November 24, 1991 has diminished my desire, albeit shortly, to obtain my ticket.

As I listened to 14.300 MHz and the Intercontinental Net attempting to assist an individual at sea who was low on fuel, I became totally appalled at the behavior of a few (emphasize few) radio operators. I have *never* heard such language, rudeness, or lack of character by amateur radio operators. The profanity, jamming, and general disrespect for priority communications left me wondering what has happened to the hobbyists whom I used to hold in high regard. Needless to say, the pile-up was so bad that the U.S. Navy had to move communications with the sea vessel to another frequency! In addition, this mayhem continued all afternoon!

To all of the amateur radio operators who practice their hobby in a professional, responsible, and dignified manner, I commend you. To all of the amateur radio operators who don't have the courage to use their callsigns when attempting to interfere with others' communications, I deplore you.

All this makes me wonder if everyone should worry a little more about the possible loss of frequency allocations.

Hank KM4PQ, Raleigh NC Ham radio has degenerated to the lowest level I have seen in my almost 40 years as a ham. X-rated radio, jamming, pejorative racial slurs, gay bashing, profanity, and graphical descriptions of sexual acts have become too commonplace.

Our frequencies are loaned to our use as a privilege pursuant to the purpose of ham radio as delineated in FCC rules and regulations, to provide for emergency communications and experimentation.

We cannot allow these miscreants to threaten our privileges. *We need to identify them and get them out of amateur radio.*

Become involved. We must coalesce together to clean up amateur radio. This is not a passive activity. We are all licensed participants. Oppose this deplorable language and conduct in our ham bands. *Ham radio is and must be self-policing.* Only we can really prevent the decline and demise of amateur radio.

Fight back: 1. Read the FCC rules and regulations as it applies to private radio. 2. Document all violations. 3. Send your documentation to the FCC. 4. Send a copy of your documentation to the radio club in the area where the violation has occurred, if known. Ask them to investigate. 5. Send a copy of your documentation to the ARRL and write to journals to express your outrage. Like community watch, we must all look out for the neighborhood or it will become a slum. 6. Once they're identified, it is imperative that we make it clear that these misfits are persona non grata in amateur radio.

If we don't protect our privileges, there won't be any privileges to protect.

See the W5YI Report, *Vol. 13, Issue 21, regarding the FCC's response to David G. Boyd K9MX. Boyd presented two years' worth of evidence "clearly obscene and properly collected" on an obscenity case, and the FCC decided not to pursue the matter because "most of the offenses occurred after 'safe harbor hours.'" Besides trying to determine whether the FCC any longer grants Section 97.113(d), which prohibits obscenity, any validity or not, he is trying to find out which world time zone governs the cutoff ("safe harbor") time. Linda KA1UKM*

73 Amateur Radio Today

FEBRUARY 1992
Issue #377

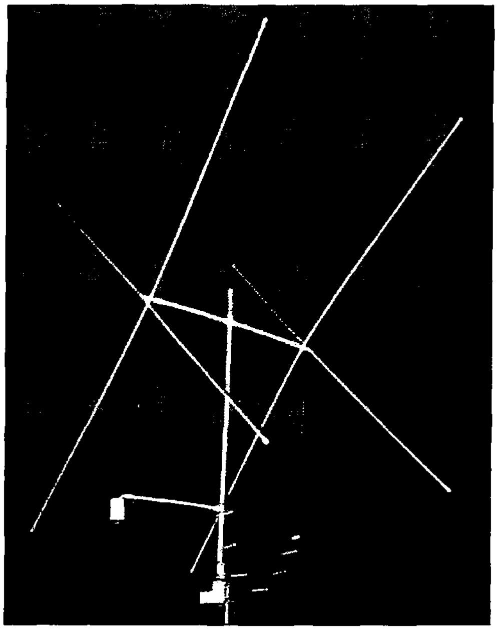
TABLE OF CONTENTS

FEATURES

REVIEWS

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things youlike best. And then wewill draw one Feedback card each month for afree subscription to *73*.



Build this PVC special for 10m. . . see page 38.

Cover: Jim HK3AVR demonstrates amateur radio for students in Murillo, Columbia.

Cover photo by Milton C. Toby KC4VLN.

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Audit Bureau of Circulations (ABC) membership applied for.

Contract: By *reading this fine print, you have become legally obligated to introduce* a *youngster to* amateur radio. Don't just park 'em in a chair to listen to you tell somebody your name, QTH and rig. Show 'em packet. Send their photo over SSTV. Let 'em talk through a satellite. Get 'em excited!

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Digital Broadcasting?

To give you an idea of how desperately far behind the state of the radio art we are, we've still got hoary old hams who are pushing for AM at a time when the world is getting ready to replace FM broadcasting stations with digital audio broadcasting (DAB).

James ZS1XN sent me a clipping about the recent BBC's tests of DAB in the Birmingham area. Most of the DAB technology has been developed by German firms such as Bosch, Telefunken and Grundig. Both the Germans and the Brits want to start DAB as soon as possible.

In the Birmingham test they compared a 1,000 watt FM signal with an 11 watt DAB signal on 215 MHz. The FM signal dropped out at about six miles from town, while the DAB signal was strong out to 15 miles. . . six times the coverage with about 1/100th the power!

They drove a bus around the city to see how the two modes compared. The FM signal suffered from flutter, pops, drop-outs and interference from computers. The DAB remained absolutely clean.

One more benefit. . . they can get about six times as many DAB channels in the same bandwidth as FM. How long do you think it's going to be before all our FM programs are moved to DAB?

And of course the DAB sound is digital, with it's incredible dynamic range and better frequency response.

So when are we going to start seeing some digital audio repeaters? With time division we could have six or more high fidelity channels on a repeater. . . or perhaps up to 20 voice quality channels. It's almost like comparing spark with CW. . . and we're holding strong for spark, just as we did in the 1920s when it took a law to force hams to stop using spark.

We had the same problem in the late 1940s getting modulated oscillators off our 2m band. Nothing less than a law could force W2KU to upgrade his kilowatt, which wiped out most of the lower megahertz of the band around Brooklyn. Good old Oscar.

If some of you will start trying digital audio and send me some articles on your work to publish, perhaps we can start bringing amateur radio out of the dark ages. Heck, I started publishing *Digital Audio* magazine eight years ago, so the technology isn't exactly new.

As David KB7HO put it in a letter, "When we first became a radio service, we had a clear-cut reason to occupy the frequency spectrum we do. We were to be a pool of trained radio operator/technicians in case of national need. If you were a ham and you were drafted or volunteered, you could go right into the radio or technical end of the service. Having a ham license gave you a very good chance to get a technical job with one of the big companies. Not any more. They don't hire hams any more. The quality that used to be there is now gone. What are we to tell the world governments? What do we have to offer in exchange for our use of the spectrum? Right now, very little. The land mobile and other radio services covet our bands. They're listening. I know personally of at least eight listening posts recording our ham bands right now to assess the use and abuse of our frequencies. These tapes have already shown up at several spectrum management councils and forums."

Thanks, David. You see, our ability to put up with the KV4FZ group on 14.313 and K1MAN on 14.275 are a national problem for us. We're kind of like battered wives who put up with being knocked around rather than fight back.

If we don't clean up our bands and get started experimenting and pioneering again, I could be publishing a ham radio memorial issue of *73* within my lifetime. It's almost something to think of as you meekly re-elect your ARRL directors every two years.

Last Chance For Fun

In my November editorial I asked if you were ready to tackle something new. . . in the music business. Several hundred readers wrote for details and almost all got very excited over what we're doing.

If you're retired or looking for something new to do. . . where you may be able to help people get more enjoyment from music. . . and where we can raise hell with the international megacorporations which have almost total control of the music business. . . read on. If you're looking for a career change. . . for something which will be real fun and can make some money too. . . check this out.

I'm giving my *73* readers the first crack at this because many of you've known me for years and I know you. I tried to get you into the computer field when it was just starting. . . and did succeed in getting quite a few who've done very well. Well, the music business isn't going to grow as fast or as big as the computer industry did, but it's going to be growing and there are some opportunities to grab.

With digital audio broadcasting (DAB) coming, there's going to be a desperate rush for programming material. . . and guess who's going to have it?

The radio industry is in a shambles right now. The recession has hit it like a ton of bricks. They're looking desperately for new formats. The old Top-40 crapola doesn't cut the mustard any more. Talk radio is beginning to be talked out. So what's next?

Ole Doc Green's got his crystal ball tuned into the next decade already. As I write this, I'm on my way back to New Hampshire from the Fresno (CA) Ragtime Festival. . . and it was a corker. I guarantee you that not one of the about 300 people who were there will ever forget the music they heard this last weekend. . . and they'll be telling friends about it for years to come.

No, I'm not trying to sell the world just on ragtime music. But I do think it's the time to start getting the whole world to listen to what our American musical heritage has to offer. . . in ragtime, bluegrass, Dixieland, theater organ, circus music, carousel band organs, Cajun and so on.

So I'm setting up a whole new sales rep organization to help distribute the major music magazines via book, musical instrument, record and hi-fi stores. . . plus as many department and discount stores as we can organize. We'll be selling CDs, cassettes, and samplers. We'll be opening new areas for music sales via restaurants, libraries, radio stations, dance studios, hotels, etc. We're going to help 250 million Americans become music conscious. . . and collectors. Then we'll start working on Europe and Asia.

After the festival, Sherry and I drove my two ragtime proteges up to see Yosemite. I flew Scott Kirby in from New Orleans for the festival and he just blew them away. He'll be up to my Golden Studios in a few weeks to record more Scott Joplin rags. . . plus some of his own. . . and superb rags by other composers.

Also with us was Masanobu Ikemiya. I think I've written about him. He's not only a classical concert pianist, but also loves ragtime music. I've got him doing Louis Gottschalk's music now and he, too, just blew away the festival people. You haven't heard Gottschalk? Oh Lordy! He was the first American composer that Europeans took really seriously. In the right hands his stuff is awesome. Much of it obviously influenced ragtime, which came about 50 years later.

While we were cruising Yosemite, I talked via the 147.03 repeater with several nearby hams and got both Masanobu and Scott all excited about hamming. All I used was a little magmount antenna I picked up at Dayton and my incredibly tiny ICOM 2SAT. It's a real gem and goes with me everywhere in the world.

Ho Hum, Another Coup

A few years ago Bruce Leek, an engineer for Telarc Records, introduced me to Captain Carl Chevallard, the conductor of the USAF Golden Gate Band. We've kept in touch, so when my trip to Fresno came up I detoured via Travis AFB, near San Francisco. It was worth it.

The band, with the help of Bruce, has made several superb CDs. Alas, being a military band, the CDs can't be sold. I'm putting on all the pressure I can in Washington to get this situation changed. It's a crime for the general public not to be able to buy and enjoy the marvelous music this and other military concert bands are producing. Fantastic stuff.

With Scott and Masanobu in tow, Sherry and I visited the band at Travis. They pulled out all the stops to make our visit memorable. They took us all through a C-5B cargo plane. This is the military version of the 747 and it's enormous. They have room to drive four large buses into one of those things.

To give you an idea, during the Desert Storm exercise they moved the equivalent of the population of Washington DC from Travis to Saudi Arabia.

The cockpit looked like a scene from a science thriller. Wall-to-wall controls, switches, dials, and instruments. Having had my own plane a while back, I looked for familiar instruments. . . and found a few.

That evening they'd freed up some simulator time for me. I'd have a chance to do some takeoffs and landings of a C-5B! Is it scary to sit down at a huge console like that, grab the wheel and start taxiing down the runway? Well, how would you feel?

The simulator was as real as it gets. It was exact in every way. You felt every bump on the runway. We felt every turn and dip as we flew. The visual was totally real. . . at night, in daytime, in bright sunlight or dense fog. It's the ultimate computer game.

Continued on page 74

QRX...

EDITED BY LINDA RENEAU KA1UKM

Promoting Amateur Radio in Africa

Last December, a new weekly amateur radio news program went on the air to promote amateur radio in developing countries. Part of the International Amateur Radio Union Region 1 plan, "News Focus Africa," is transmitted from Johannesburg, South Africa, under the auspices of the PADC (Promotion of Amateur Radio in Developing Countries) Working Group. The station ID is ZS6NFA.

According to Hans Welens ON6WQ, Chairman of the PADC Working Group, "The program includes up-to-date news, technical discussions, and amateur radio related educational material." He added that the introduction of the scheme will greatly extend the work that is already being done in Lesotho, Swaziland, Mozambique, and other parts of Africa. In these three countries, the PADC Working Group is setting up HF club stations to demonstrate and teach amateur radio. This program is linked to the establishment of active educational groups to technically qualify new amateurs. The Working Group program has already made important contributions, of which the reestablishment of amateur radio in Mozambique is an excellent example.

"News Focus Africa" will be produced and presented by Hans van de Groenendaal ZS6AKV and Gerald Klatzko ZS6BTD with material supplied from all over the world, transmitted on Sundays at 0715 UTC on 14.282 and 21.282 MHz SSB, and on AM on 3660 and 7059 kHz. The program is repeated Monday at 1700 UTC on the same frequencies. *[Ed. Note: The reception was excellent into New Hampshire on 15m during their first 1700 UTC program. WB8ELK.]* Amateur radio can play a positive role in creating an interest in electronics, and can often strongly motivate young people to consider a career in this field. Amateur radio can also make valuable contributions during natural disasters. When normal communications fail or become overloaded, amateur radio can provide an important backup system.

The first programs are 15 minutes long, but will become longer if the response is good. Says van de Groenendaal, "We welcome contributions in text or audio form. Audio cassettes should be mailed to NFA, P.O. Box 807, Houghton 2041, South Africa. Text may be sent by mail or via packet radio to ZS6NFA@ZU8NRC or ON6WQ @ ON7RC." More details about "News Focus Africa" can be obtained from the PADC Working Group, %South African Radio League, P.O. Box 807, Houghton, 2041, South Africa. Tel. (011) 484-2830. CompuServe: 70262,3652; INTERNET: AMSAT@FRD.AC.ZA; T-Mail: HANSV; Sprint TELEMAIL: HANSV. TNX *Westlink Report, Nov. 14.*

RM-7849

The petition ot Michael R. Reynolds WØKIE of Tulsa, Oklahoma, seeking secondary status for certain communications over amateur frequencies, was accepted by the FCC for comment last November. RM-7849 requests that the Amateur Radio Service rules be amended to permit incidental music in communications originated by the National Aeronautics and Space Asministration, and to expand the permissible NASA communications. Comments on RM-7849 were closed on November 28.

Reynolds also asked that a previous petition for reconsideration, filed April 23, 1991, be withdrawn. That petition requested reconsideration of the denial, on April 5, of his petition to retransmit NASA public communications and the Voice of America. The FCC granted Reynold's request. TNX *W5YI Report, Vol. 13, Issue #23.*

Two-Ways to Moscow

Motorola's Radius line of two-way radio products are to be distributed in the Soviet Commonwealth (?) this year by Radio Communications International, which has offices in New York and Moscow. These radios will be manufactured in Mt. Pleasant, Iowa, and Basingstoke, England.

Radio Communications International has signed up seven dealers in the Soviet Commonwealth (?) and plans to establish more dealerships by the middle of next year. Dealers will be assigned regional territories. About 98 percent of the Radius product line is geared to the commercial market, and likely prospects in the Commonwealth (?) include oil companies, construction firms, geologists, livery and delivery fleets, and security services.

Sale of the radios will be only in hard currency for starters, but the market may open up if the ruble becomes convertible to other countries' monetary units. TNX Chuck Gysi-N2DUP via *The Pulse,* newsletter of the Quad City Amateur Television Club.

Ham of the Year

Attention! March 15 is the deadline for nominating a young ham to receive the Westlink Report Young Ham of the Year Award. The award, once again to be underwritten by Yaesu, is given annually to a radio amateur 18 years of age or younger who best epitomizes the accomplishments of young people in amateur radio as related to community service on a local, regional, or national level; service to amateur radio itself on a local, regional, or national level; promotion of high ethical and moral values through amateur radio; education through or with amateur radio; or any combination of the foregoing.

To qualify, a candidate must hold a valid FCC Novice class or higher amateur license, be a resident of the U.S., and attend an accredited learning institution. A nominating petition must be filled out detailing accomplishments of the nominee and be received by the above date. Send an SASE to request a nominating petition to 1992 Young Ham of the Year, *Westlink Report,* 28197 Robin Ave., Saugus CA 91350.

The winner receives a plaque from the *Westlink Report,* an expense-paid trip to the 1992 Dayton Hamvention to receive the plaque, and a surprise from Yaesu, as well as items from several industry leaders for the winner and the winner's school or club. TNX *Westlink Report, No. 614.*

DARA Scholarships

The Dayton Amateur Radio Association is now accepting applications for its annual $1,500 scholarships. Licensed amateurs graduating from high school in 1991 are eligible. For further information and application forms, write DARA Scholarships, 317 Ernst Ave., Dayton OH 45405. TNX *W5YI Report, Vol. 13, Issue #23.*

Earthwinds Update

The Earthwinds around-the-world manned balloon flight is currently scheduled for anytime after January 15. Thanks to the efforts of Bob Rau N8IYD, Jud Nichols and Bill Brown WB8ELK, a voice telemetry system has been developed to relay the balloon's position via the gondola's GPS location system (High Technology Flight MCM4 microcontroller and voice ID [see the Nov. issue of *73,* p. 9]). During the mission, listen for the Earthwinds signal at 15, 30, 45 and 55 minutes past each hour on 28.303 MHz (USB). Each transmission will be in the following format: "KB7JGM Earthwinds, XX XX.XX North, YY YY.YY West (or East) ZZZ" where XX XX.XX is the latitude in degrees, minutes and hundredths of minutes; YY YY.YY is the longitude in degrees, minutes and hundredths of minutes, and ZZZ is the ground speed in knots.

For recent updates on the Earthwinds status as well as other amateur radio balloon experiments, check into the 73 BBS at (603) 525-4438. Select the "Message" section and go to 'Area 13' (the Balloon SIG).

TNX...

...to all our contributors! You can reach us by phone at (603) 525-4201, or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 525-4438 (300-2400 bps), 8 data bits, no parity, one stop bit. FAX: (603) 525-4423.

The Copper Cactus J-Pole

For 2m and 70cm.

by John Post KE7AX

Remember those Novice days when you ran your 40 meter dipole on 15 meters? Have you had your eye on one of the fancy new dual-band radios? Does the idea of putting up two separate antennas and running two feedlines pour cold water on your enthusiasm? Well, if you enjoy home-brewing, this may be your cup of tea!

This probably makes you think of using one antenna, cut for a particular frequency, on a multiple of that frequency. Fifteen meter frequencies consist of roughly the third multiple of frequencies in the 40 meter band, just as amateur frequencies in the 70cm band (440 MHz) are roughly the third multiple of frequencies on the 2 meter band, our most popular amateur band.

Since I was making a J-pole antenna for the 2 meter band, I decided to try the antenna on 440. I was pleasantly surprised to find that it worked reasonably well. However, I was concerned because the SWR curves didn't bottom out. After making several changes, I plotted new SWR curves, and decided on the dimensions shown in this article. You can change the dimensions slightly, but be careful! Changing the dimensions will change both bands.

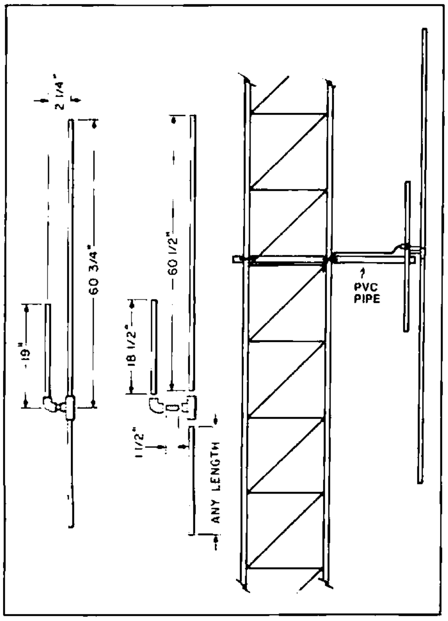


Figure 1. The Copper Cactus, and a typical Double Cactus installation.

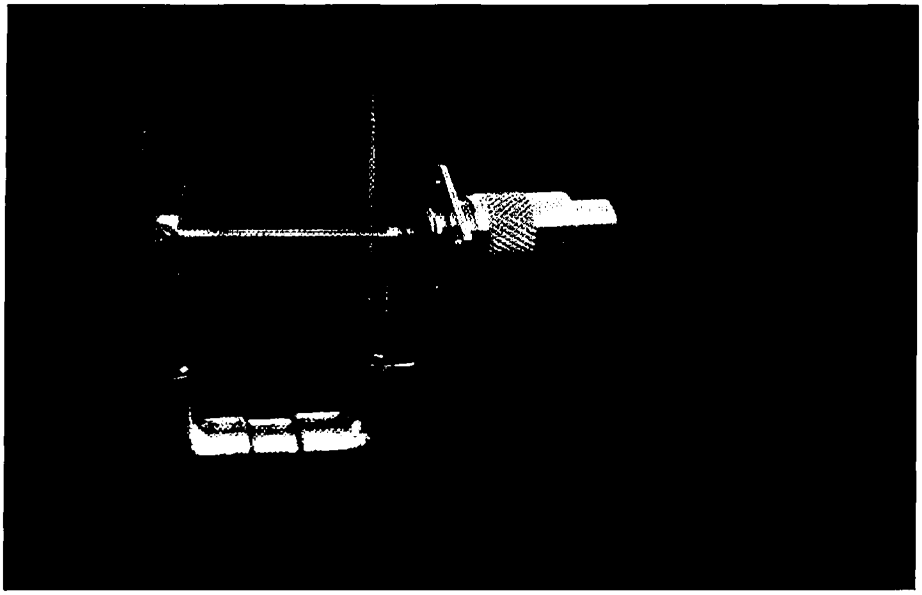


Photo A. Details of the feedpoint. Rivet one corner of the SO-239 connector to the short section of the Copper Cactus. Run a #12 wire from the center pin of the connector and solder it to the long section of the antenna. Make sure the center conductor doesn't touch the short section.

Before you construct this antenna, I want to emphasize that I designed it primarily for use on 2 meters, and it will radiate most efficiently on that band. But you can get on the 440 band quickly and enjoy your dual-bander right away. It does LISTEN very well on 440. It is employed locally as a single antenna for a crossband repeater system. In this system, it listens on 440 and transmits on 2 meters.

One thing is certain: It's hard to beat the cost and fun you will have building the Copper Cactus!

Construction

1. Cut a 10-foot piece of 1/2" copper water pipe into the following sizes: 60-1/2", 18-3/4", and 1-1/2". The mounting tube may be any length. (You will have a section about 3 1/2 feet long to cut the mounting piece from.) See Figures 1 and 2. Special thanks go to Gary Rogers WR7L for assistance with the technical drawing.

2. Clean all the pieces where they will be inserted into the T and elbow fittings. Assemble the antenna and check your dimensions.

3. Disassemble the sections, flux the ends

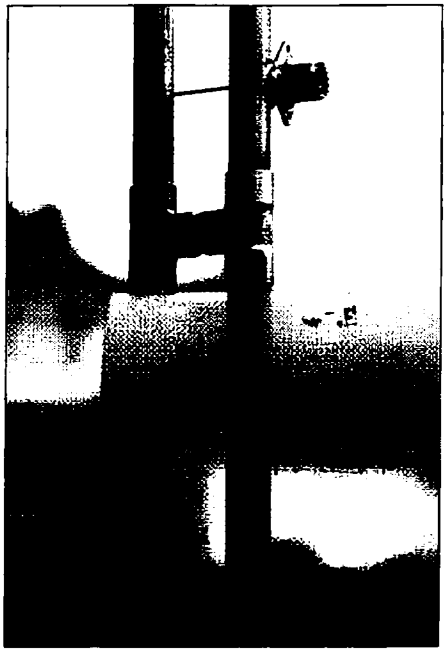


Photo B. Run the long section of the Double Cactus through the PVC pipe to secure it to the tower side mount.

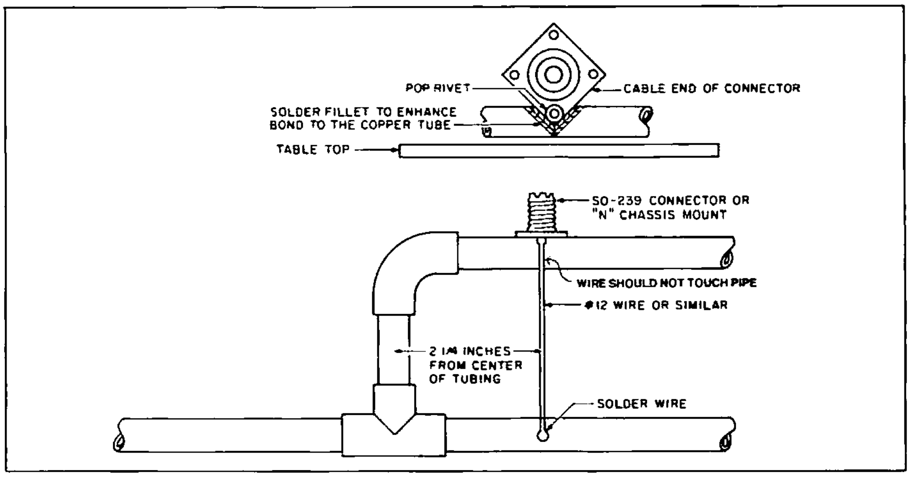


Figure 2. See the materials list. Before soldering, clean the joints and place the assembled antenna on a flat, noninflammable surface. Practice on some scraps of tubing and extra pipe joints if you're new to this. All dimensions are center-to-center.

that will be reinserted into the fittings, and reassemble the antenna, taking care to re-check the dimensions before soldering.

4. Carefully solder your antenna together. Make sure the matching stub and radiator element are parallel. You will need to turn the antenna over to solder the fittings on the other side. Use the minimum amount of solder, but make sure the antenna is stout!

5. After the initial soldering is done and the antenna is cool, measure the spot where the feedpoint will be located. Also, clean and mark the spot on the long radiating element where you will solder the wire from the center of the chassis mount.

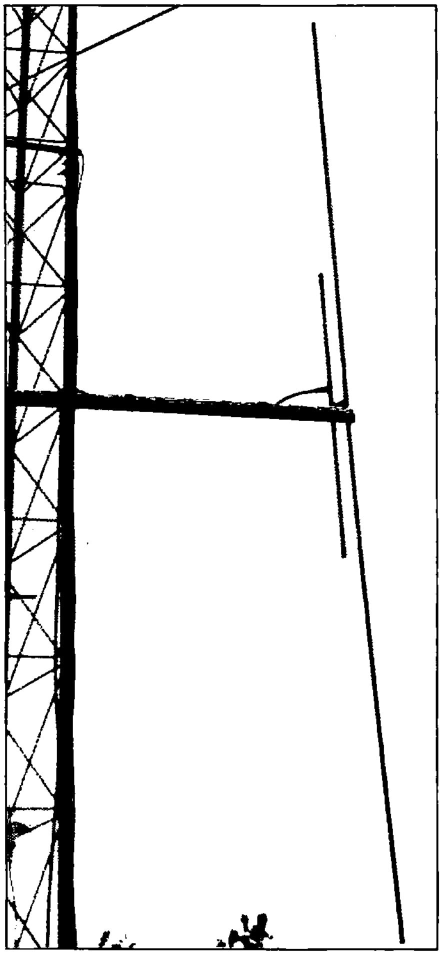


Photo C. Use PVC pipe to mount the Cactus to the side of your tower. The Double Cactus is shown here.

6. Now you get to make a decision! You will need to drill a hole in the short section for either a pop rivet or machine screw. This will help secure the chassis mount to the antenna. If you use a machine screw, choose one that is long enough to allow a nut to be placed on the other side of the short section. Approximately one inch should do it. Also, you will need to drill out the hole in the chassis mount that will accommodate the screw/rivet. Make sure it isn't too fat, or you'll find yourself with too large a hole in the chassis mount. I use 1/8" aircraft-grade pop rivets, but I have made several antennas with machine screws. They all work fine. If you have any qualms about the quality of your rivets, go with the machine screw.

7. Place the chassis mount where it will be located, and mark the spot. Carefully drill the hole in the short matching section. If you are using a rivet, just drill in the outside wall. If you chose the machine screw, drill it all the way through.

8. After drilling the hole to match in the chassis mount, secure it to the matching stub with either the rivet or machine screw. Make sure the threads face away from the radiating element! Your chassis mount should be very secure to the matching stub.

9. Now, go find an old connector to use as a heat sink while you place a bit of solder on the spot where the chassis connector meets the matching stub. Solder this area carefully. Apply the heat to the copper pipe, and the chassis connector will be warm enough for the solder to adhere to. This will make a good electrical connection and enhance the mechanical one as well. Remove the old connector from the chassis mount and check the insulation for distortion/melting. It should be fine. (Unless you applied the flame directly to the chassis mount.) I also use an extra T-connector for a head sink; you can do whatever you want.

10. With the torch, heat the spot where the feed wire will attach on the radiating element. Place a small bead of solder on the spot. It should be directly across from the center of the chassis mount.

11. Cut and strip the ends of the wire that will go from the center of the chassis mount to the feedpoint. Solder one end to the chassis mount, using a soldering iron, NOT the torch! Tin the opposite end where it will attach to the radiator, and try to attach it with your iron. If you can't get the feedpoint hot enough with the iron, use the torch carefully and secure the wire that way.

12. Let the antenna cool, then check all fittings for security. They should be very strong. Clean up the antenna with some steel wool, taking care not to leave any small "hairs" behind. Check the SWR on both bands and paint the antenna as desired. Enjoy your new dual-band Copper Cactus!

Now—the Double Cactus

This one is for those of you who love BIG antennas. It is built using the same basic procedure as above. However, instead of a 90-degree connector, buy two T-fittings. Also, cut the matching sections 1/2" longer. Buy two 10-foot sections of copper pipe and build a mirror image of the standard Cactus below itself.

I use a 5-foot section of 1-1/2" PVC pipe to suspend the Double Cactus from the side of my tower. This seems like the best way to do it. Just drill a 5/8" hole about one inch in from the end of the PVC pipe, and slide the long leg of the antenna down through it. The feedpoint will be above the PVC, allowing you to secure the feedline to it. When comparing this antenna to the standard J design, we found a stronger signal report on both bands. The reports weren't much stronger—maybe one or two S-units—but you may find that this antenna meets the need better. I have a standard J on the top of my mast, and the extended version off the side of the tower.

Continued on page 27

The Copper Cactus
Materials List

1	10-foot section of 1/2" copper water pipe
1	T-section
1	90-degree elbow
1	SO-239 or N-type chassis mount
1	2-1/2" piece of no. 12 or similar copper wire
1	machine screw, about 1" long, with nut; or pop rivet 1/8" dia. x 1/2" long

Other: Propane torch, solder for copper pipe, and flux.

A Five-Component Wideband Amplifier for Your Receiver

Give your VHF receiver a boost!

by J.S. "Stu" Gurske K9EYY

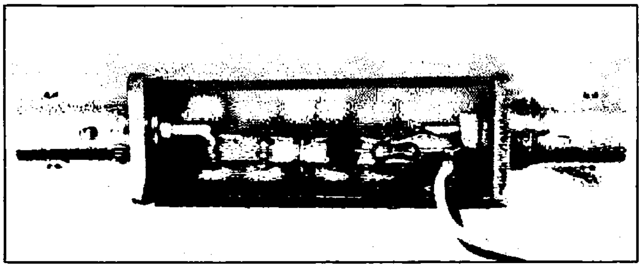


Photo A. Close-up of the finished amplifier: MAR-8 (center), chip caps, resistor, stand-off insulator bead on the resistor lead, BNC connectors and 12 volt wires.

Imagine a very wideband amplifier which covers a range of from about 100 MHz to 2,000 MHz, and requires only four other components to make it work. The Mini Circuits catalog lists just such a device, called a MAR-8. It is extremely small, measuring about 0.078 (5/64) inch in diameter by about 0.62 (1/16) inch thick. It has a gain of about 33 dB at 100 MHz, pretty impressive for such a small device.

Getting It Together

I needed a preamplifier for one of my VHF receivers and decided to try this device. I obtained a MAR-8, two 100 pF chip capacitors, a 120 ohm 1/4 watt resistor, and a ferrite bead and hooked it all up. The amplifier worked very well. I heard signals which I had never heard before. The old marginal signals were now fully quiet. This amplifier makes a nice weekend project.

The amplifier uses chip capacitors so, while some care must be taken when soldering them into the circuit, constructing the amplifier was easy. Here is how I did it.

It's easy to make a printed circuit board, but I chose to hard wire the device instead. I mounted five small standoff insulators on a piece of copper-clad board (i.e. double-sided printed circuit board material) as shown in Figure 2. The circuit board material measured approximately 1/2" wide by 1-1/2" long. After mounting BNC connec-

Continued on page 49

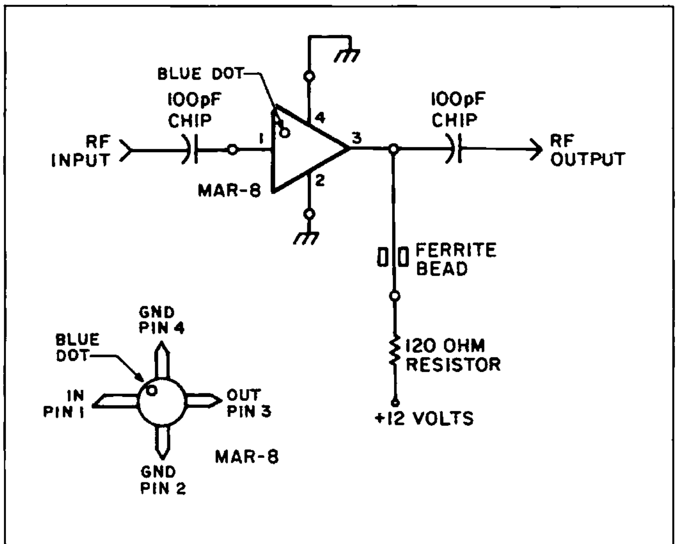


Figure 1. Schematic for the 5-component RF amplifier.

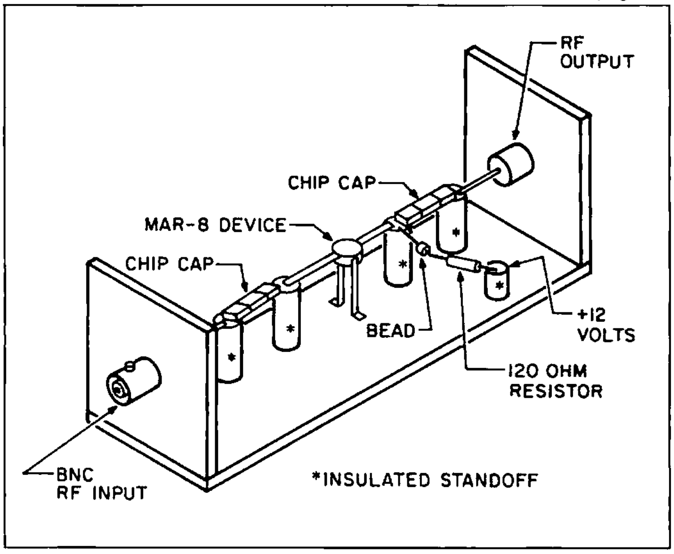


Figure 2. Parts placement for the RF amplifier assembly.

73 Review

by Dick Goodman WA3USG

Vector Control Systems
1655 North Mountain
Suite 104-45
Upland CA 91786
Tel. (714) 985-6250.
FAX: (714) 985-3482.
Price Class: $190.

VBI-360 Beam Indicator

Put your rotor display on the wall.

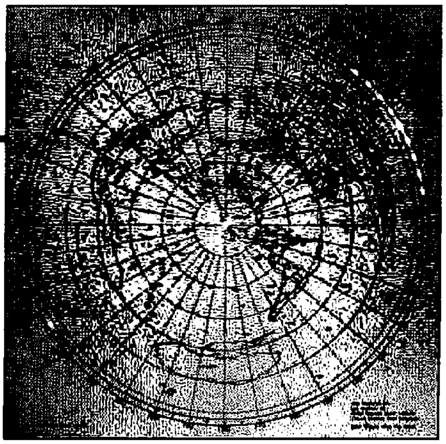


Photo. The Great Circle Map Vector Beam Indicator is attractive as well as functional.

Knowing precisely where to point an HF beam has always been a problem for amateur radio operators. Since radio waves propagate along the shortest path between two points, and the earth is a sphere, using an ordinary map (known as a Mercator projection) to determine antenna-pointing requirements can be very misleading.

Using a Globe

One effective way to resolve this problem is to obtain a globe and mark your location on it. Then, using a compass, draw lines of bearing outwards from your location, like the spokes of a wheel. Drawing a radial for at least every 10 degrees of azimuth will result in a highly accurate method of aiming the antenna. Path determination simply entails locating the radial closest to the target location and following it back to its origin (your QTH). Target locations not positioned exactly on a radial may be estimated within a few degrees.

The advantages to this method are: 1. Globes are cheap. 2. A globe, like the earth, is round, which virtually eliminates errors. 3. The shape of the continents and land masses are recognizable to anyone with a rudimentary knowledge of geography.

I have used the globe method and it works quite well! In addition to determining antenna direction, it gives you a unique perspective of the earth as seen from your QTH.

The Circle Map Method

For those not so artistically inclined, there is an easier way. A flat projection of the spherical earth, known as a "Great Circle Map," will work as well. The disadvantages are: 1. In order to be useful for bearing determination, it must be customized by having the user QTH drawn at the center. 2. Converting a spherical surface to a flat map distorts the appearance of many of the continents. But these disadvantages are not major. With computerized cartography, it's easy to generate customized Great Circle Maps for any point on the earth.

In the past, several mechanically proficient amateurs have built beam direction indicators based on the Great Circle Map. Many of these systems were almost works of art, and provided accurate antenna aiming requirements quite well. Unfortunately, these projects also used quite a few mechanical components and servo system techniques beyond the capabilities of the average ham. What was needed was a way to create an equivalent system electronically, and to eliminate all expensive mechanical components.

The VBI-360

Vector Control Systems of Upland, California, has created an attractive, solid-state (no moving parts) beam indicator known as the Model VBI-360. The 16" x 16" x 1" unit consists of a Great Circle Map with your location in the center. There are 72 high-brightness LEDs around the map's periphery to indicate your beam pattern. There is also a single LED identifying your QTH, and an LED marking the long path direction.

The map is professionally plotted on a heavy "parchment" type plastic material. Coastlines are in black, country boundaries in green, callsign prefixes in red, and radial lines and distance circles in blue. Your location and corresponding latitude and longitude are printed in the lower right-hand corner of the map. The unit is enclosed in an attractive aluminum frame and the map is protected under glass. Designed to be hung on the wall like a picture, the VBI-360 is controlled and powered by a single cable, and will function with virtually any rotor that uses a potentiometer to feedback analog position information.

Documentation provided with the VBI-360 is excellent. The users manual consists of 14 pages of considerable detail on installation, calibration, and troubleshooting. A complete schematic is also provided.

Physical Connections

To say that the VBI-360 is easy to connect and use is an understatement. The '360 comes with approximately 10 feet of cable with a modular phone type connector installed. There is no need to do any wiring to the indicator itself. Also included is a modular phone type connector box which is designed to be fastened to the back of the rotator control box. A 12 VDC wall power supply is provided, and comes connected to this modular connector box.

The only physical wiring that has to be done is to three wires coming from the connector box. These wires are: BLACK, to the rotor control box ground; YELLOW, to the wiper of the position feedback pot in the rotor; and BLUE, to the top of the rotor position feedback pot (+ voltage). These wires are only about four inches long. I used Radio Shack shielded cable (with two inner conductors) to extend these wires 10 feet to my rotor control box.

It should be noted that the blue wire only has to be hooked up if you desire the indicator to be automatically energized when the rotor control box is turned on. If the this wire is not connected, the indicator will always be energized, and may be switched on and off from the outlet. Grounding this wire will unconditionally de-energize the indicator.

Connection of the VBI-360 to my Yaesu G1000SDX took all of 10 minutes. For most rotor control boxes it will not be necessary to open the case. Connection of the three wires may be made to the terminal strip, or to the connector on the rear of the control box. The following rotors will work with the VBI-360: the Alliance HD-73; HAM-M Series I, II, III; HAM-II, III, IV; CD44, 45, Tail-Twister; HDR-300; ORION 2300; EMOTO 105TSX; and Yaesu models G-400, 600, 800, 1000, G800SDX, and G1000SDX.

Other rotors that use a potentiometer for position reporting should also work. The rotor endpoints, adjustable over 360 degrees, allows the rotor to be mounted with its physical stops in any position. Finally, the VBI-360 works with rotors that rotate either clockwise or counterclockwise to achieve a more positive voltage on the position feedback pot wiper.

Configuration and Calibration

Calibration and setup of the VBI-360 is simple and straightforward. The VBI-360 will work with rotors that use a range of positioning voltages from 0.5 to 30 VDC.

Switch configuration on the rear of the VBI-360 is then set to match this voltage value. Insert the modular plug from the indicator unit into the connector box, and apply power to the rotor control box. Several LEDs should illuminate. Adjust the "Span" and "End Limit" pots on the VBI-360 in accordance with the documentation. Finally, the beamwidth of your antenna should also be set via four switches on the rear of the VBI-360.

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 29 cents!

Feedback# Title

This entire process took me five minutes, and resulted in perfect calibration.

If you have a non-standard rotor or one that's not on Vector's list, the map display can be calibrated by the following procedure: Prior to connecting the modular plug from the indicator assembly to the connector block, energize the rotor control box, rotate your beam to its maximum clockwise position, and measure the position feedback pot wiper arm voltage with respect to ground.

Rotate the antenna until this voltage is the maximum positive obtainable. It should be noted that some rotors require full counter clockwise rotation to obtain the max positive voltage.

Operation and Use

Once the VBI-360 is calibrated, rotating your antenna will result in an arc of LEDs moving along the periphery of the Great Circle Map. The size of this arc is proportional to the beamwidth of your antenna. The center LED in the arc is noticeably brighter than the others, and marks the exact heading of your beam on a compass rose surrounding the map with a resolution of 5 degrees. A single LED at 180 degrees from beam center indicates the long path. This may be turned off if desired. Finally, a single LED illuminates your own QTH at the center of the map.

The effect of this is quite striking! It is instantly apparent where your beam is pointed, and what coverage it is providing.

Pointing your antenna at Australia is as simple as rotating your beam until the arc of LEDs is adjacent to that continent. If a call is heard from another location, moving your antenna is a snap!

Comments and Kudos

A very important aspect of any accessory found in a ham shack is RF filtering. The circuit for the VBI-360 is on a Mil-Spec quality double-sided board with an extensive ground plane. The circuit and board layout have been designed to eliminate the effects of high RF fields. In addition to RF filtering, an active 3-pole low pass filter is used at the front end to reduce the effects of superimposed AC on the DC signal that occurs with rotors that use a wire common to both the pot and motor. I noticed absolutely no effect on the display with high power HF (2 kW on 75–15 meters) and VHF/UHF (150 watts on 2 meters and 70cm) operation.

The VBI-360 is a very attractive addition to any ham shack. High quality materials and construction are used throughout. Silver, black or custom frame colors are available. I was especially impressed with the quality of the Great Circle map. It is actually customized right down to your town, which must be specified when you place your order. The map is easy to remove and replace, which will make it nice if you ever decide to move.

Finally, the indicator could be truly customized to a local area by "rolling you own" map. For example, VHF operators may want coverage over only a single state, or a two- or three-state area. The folks at Vector Control Systems might want to consider this as a future option.

The VBI-360 is an attention-grabber and quite a conversation piece. Another very nice attribute is that it is the type of accessory that may be safely bought by a non-ham spouse for the OM of the family. IT MAKES A GREAT BELATED CHRISTMAS OR BIRTHDAY GIFT. . . hint, hint!

73 Review

by David Cassidy N1GPH

The AL800 High Gain HT Antenna

Improve your dual-band portable punch.

ANLI International Corp.
15344 E. Valley Blvd., Unit C
City of Industry CA 91746
(800) 666-ANLI
Price Class: $40

ANLI is a company that has been around for quite a long time—about 30 years. Their extensive line of amateur and commercial products is well known in Asian countries, but is essentially unknown in North America. With the introduction of the AL800, as well as other HT accessories, ANLI is dipping a cautious toe into the U.S. ham market.

The AL800

The AL800 is actually two antennas. The first is a thin, flexible rubber whip which gives you about the same performance as the rubber ducky that came with your HT. Most stock HT antennas are not very flexible and will jab you in your side all day if you walk around with the HT on your belt. After an hour or two of walking around with the short ANLI antenna, you will appreciate its flexibility.

The second antenna that comprises the AL800 is a stiff telescoping whip. When fully closed, it is about the same size as a stock dual-band HT antenna. When extended to its full length, the AL800 gives remarkably improved performance in both transmit and receive on both 2 meters and 70cm.

The two antennas screw into a common base, so switching between the convenient and comfortable rubber whip to the better performing but larger collapsible element requires no more than a few twists of the wrist. Both elements are small enough to fit in a breast or coat pocket, so carrying both while operating public service or around the hamfest is no problem.

Real World Tests

ANLI claims a gain of 3 dB for 2 meters and 5.2 dB on 70cm. They don't state what their reference antenna is, but we all know that manufacturers' claims of gain don't mean much. What counts is how the thing works in real-world situations.

One of my favorite places for testing HT antennas is hotel rooms. With concrete walls and miles of parasitic wiring around you, it provides a real performance test, when compared to a stock HT antenna. If an HT antenna can get a signal out of a hotel room, it will probably work well anywhere.

I found the short, flexible whip of the AL800 to give identical performance to a stock HT rubber ducky. The same S-meter readings were also obtained with the collapsible whip in the fully closed position.

When you extend the collapsible whip to its full length, the difference is immediate and amazing. Repeaters received at an S-3 gave a full meter reading with absolutely no noise. On transmit, I received "full quieting" reports on repeaters that I couldn't even key up with the shorter antennas.

I received the exact same results with two different HTs, in many different operating locations. SWR was measured as less than 1.5:1 across the repeater sections of both 2m and 70cm.

Construction

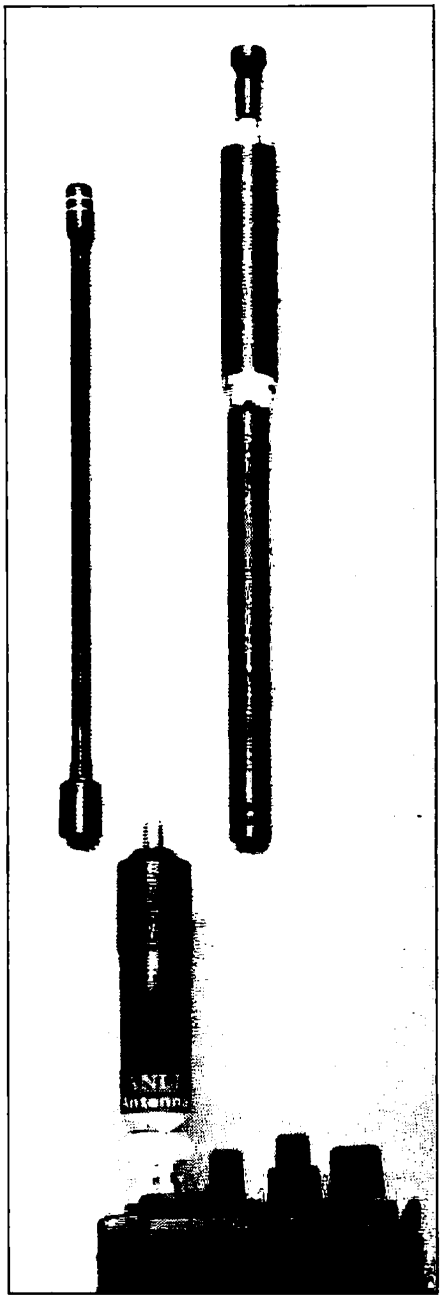
The ANLI AL800 is an attractive antenna. The elements are flat black, with gold-tone connectors. The extendible whip feels solid, with no slippage. The two antenna elements screw in very firmly, and I never experienced any problems with this arrangement.

Final Thoughts

If you are in the market for a high gain HT antenna, the ANLI AL800 would be a good choice. The price is a little higher than similar products from other manufacturers, but remember that the ANLI AL800 really gives you two antennas.

It is always good news when a new company enters the amateur radio market. While ANLI is by no means a new company, it is a new name to the U.S. ham market, so the result is the same.

Representatives of ANLI International Corp. tell me they have over 100 products for the amateur market. I found the AL800 to be a quality product, and I look forward to seeing more ANLI products in the U.S.



The ANLI AL800 antenna.

An NE-602 RF Signal Generator

Useful test equipment from a versatile IC.

by Julian Kerr

The Signetics NE-602 chip has intrigued many people, partly because it is versatile and partly because it is well behaved. What does "well behaved" mean? It means that the chip does what it's supposed to do with little effort on your part. It is an RF device, so you have to be careful with matters such as component selection and layout, but it will work well for you if you just follow a few simple rules. I experienced no problems in a weekend of experimentation in preparation for this article.

Another of the NE-602's attractions is that it is easy to get. As an electronics hobbyist, I am frequently distressed at published circuits that work wonders, but require chips that aren't available through most distributors. Furthermore, major industrial distributors will normally deal with individuals on a cash-up-front basis only (some will do COD), and have a minimum order of $50 or $100. Fortunately, the NE-602 is available by mail from Digi-Key at P.O. Box 677, Thief River Falls MN 56701-0677; (800) 344-4539.

The NE-602 is an 8-pin mini-DIP integrated circuit double-balanced mixer with a built-in oscillator (see Figure 1a). The mixer works up to 500 MHz, while the oscillator works up to 200 MHz. There are two balanced inputs (labeled "Input-A" and "Input-B") and two balanced outputs (labeled "Output-A" and "Output-B"). Both the inputs and the outputs can be used in a single-ended, rather than balanced, configuration. The pinouts of the NE-602 (see Figure 1b) are listed in Table 1.

Much of what has been written thus far about the NE-602 has centered around its uses as a receiver or a frequency converter. Indeed, the NE-602 makes a dandy little single-chip RF front end and will provide a high degree of sensitivity and a low noise figure in that application. In addition, because it is a double-balanced mixer, the LO and RF signals are suppressed in the outputs, so only the sum and difference IF frequencies (LO ± RF) exist in the output. In this article we are going to examine the largely-overlooked oscillator function of the NE-602.

NE-602 Oscillator Circuits

In normal receiver or frequency converter applications, the local oscillator signal generated inside the NE-602 is suppressed in the output. This is an excellent feature to have in a receiver front-end, accounting for the use of double-balanced mixer circuits in high priced communications receivers. But if we unbalance the RF input (pins 1 and 2), then the LO signal will appear on the two output terminals of the NE-602 (pins 4 and 5).

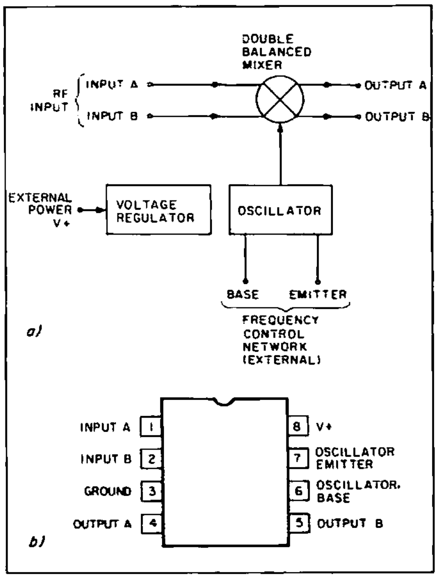


Figure 1. a) Internal circuit of NE-602 in block form; b) pinouts of the NE-602.

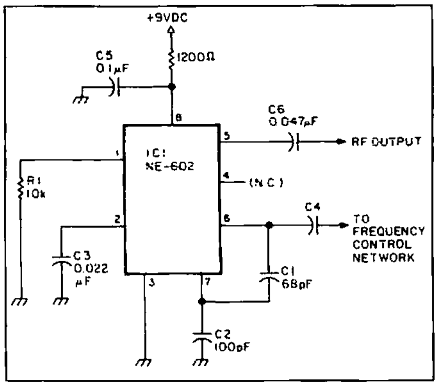


Figure 2. Generic NE-602 oscillator circuit.

Figure 2 shows the basic configuration of the NE-602 in oscillator mode. Input-A is grounded through a 10k ohm resistor, while Input-B is bypassed to ground for RF signals through a capacitor (C3). The value of this capacitor is dependent on the operating frequency. The value shown will work nicely in the HF and low VHF range, but for lower frequencies use a higher value. In general, the capacitor should be 0.001 µF to 0.01 µF for VHF, 0.01 µF to 0.05 µF for HF, and 0.05 µF to 0.33 µF for VLF through low HF frequencies.

As is true for all bypass capacitors, mount C3 as close to the body of the NE-602 as possible. Use disk ceramic, mica or other capacitor types that work well at the frequency of operation. Not all capacitor types that work well in audio or other low frequency circuits will work at RF. The catalog description of the capacitor will tell you its intended uses.

The NE-602 works from DC power supplies in the +4.5 to +8 volt range, and draws 2.4 to 2.7 mA of current. If higher voltage operation is required, then you must use one of two tactics. For +9 volt DC power supplies (meaning battery operation is possible), insert a 1000 to 1500 ohm resistor in series between the V+ power supply and the V+ terminal (pin no. 8) on the NE-602. For even higher voltages, use a three-terminal IC voltage regulator that drops the voltage to 5, 6 or 9 volts. In the latter case, use the 1000 ohm series resistor as well.

The V+ pin is bypassed to ground for RF by a capacitor (C5). The same approximate value ranges described above for C3 are also valuable for this application. Again, mount the capacitor as close as possible to the body of the NE-602.

The output signal can be taken from either pin no. 4 or pin no. 5. I used pin no. 5 because of layout considerations on the perforated board that I used.

The NE-602 oscillator circuit contains an NPN transistor and supporting circuitry, and can be used in all of the normal oscillator configurations that don't require access to the collector terminal. Two examples are the Colpitts oscillator and the Hartley oscillator. For the purposes of illustrating NE-602 oscillator circuits, all but one example will be of the Colpitts oscillator configuration because the Colpitts oscillator uses a tapped capacitor voltage divider (C1/C2) for feedback, while the Hartley configuration uses a tapped inductor. The latter is a little harder to build; the Colpitts works well for most applications.

The values of C1 and C2 determine the stability of the oscillator, and indeed whether or not the circuit will oscillate at all. The approximate values are as follows:

$$\text{Equation 1:} \quad C1 = \frac{100\text{ pF}}{\sqrt{F_{MHz}}}$$

$$\text{Equation 2:} \quad C2 = \frac{1000\text{ pF}}{F_{MHz}}$$

In terms of standard capacitor values, these equations translate to the approximate values shown in Table 2. These values are not absolute, and I found it possible to make good oscillator circuits with values different from these, including the project at the end of this article.

An example of the output signal from the circuit of Figure 2 is shown in Photo A. This signal is from a 10 MHz crystal oscillator (see below), and appeared on both pins 4 and 5. It had an amplitude of about 180 mV, which is more than is normally needed for a signal generator.

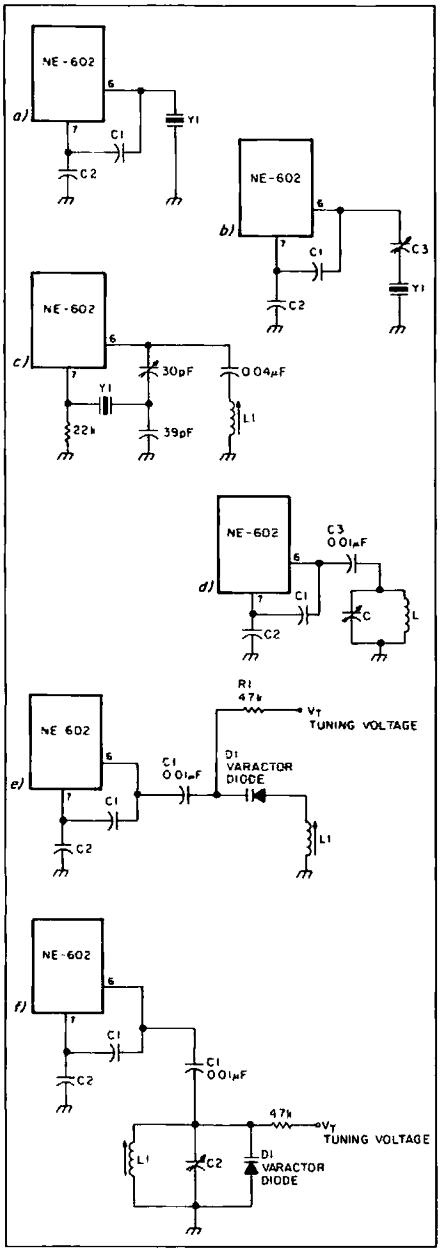


Figure 3. Oscillator frequency control networks: a) simple fundamental mode crystal oscillator; b) adjustable fundamental mode crystal oscillator; c) Butler third overtone oscillator; d) LC tuned VFO; e) series tuned voltage variable VFO; f) parallel tuned voltage variable VFO.

NE-602 Oscillator Frequency Control Networks

The rest of the oscillator circuit consists of the frequency control network (not shown in Figure 2). This network can be a piezoelectrical quartz crystal resonator, a ceramic crystal resonator, or an inductor-capacitor (LC) network. Figure 3 shows several possible variations on the frequency control network.

Figure 3a shows a crystal oscillator circuit. The piezoelectric quartz crystal (Y1) is operated in the parallel fundamental mode, so it is connected in parallel with the oscillator circuit. Because a crystal has an extremely high resistance to DC, there is no need for a DC blocking capacitor between the NE-602 and the crystal.

One problem with the circuit of Figure 3a is that the frequency is not adjustable. The frequency of any crystal resonator is a function of, among other things, the capacitance of the load seen by the crystal (most crystals are calibrated for 20 or 32 pF loads). Because of tolerances in the crystal manufacture, and the values of the external capacitor network (plus stray capacitance, which is significant in RF circuits), the actual frequency and the marked frequency might be different. By placing a variable trimmer capacitor in series or parallel with the crystal (Figure 3b), we can make the actual oscillating frequency adjustable. You can use an insulating tuning wand (a.k.a. "diddle stick") to adjust C3 for the correct operating frequency.

The non-Colpitts oscillator circuit referred to above is the Butler overtone crystal oscillator shown in Figure 3c. The previous two crystal oscillators operate in the fundamental mode, while in Figure 3c the crystal oscillates in the third overtone (similar to harmonic) mode. A fundamental mode crystal is only good to about 20 MHz because the crystal slab becomes too thin above that frequency and is therefore likely to fracture. But, in the overtone mode we can accommodate high HF and VHF frequencies without making the crystal too thin for safe operation.

A variable frequency oscillator (VFO) circuit is shown in Figure 3d. In this circuit the resonator is replaced with an inductor-capacitor (LC) network that tunes the oscillator. Because the inductor has a low resistance and is connected to ground, a DC block capacitor (C3) is used between the LC network and the NE-602. A variation on this theme is the Clapp oscillator in which the inductor and capacitor are in series rather than parallel.

Figures 3e and 3f show voltage-tunable oscillator circuits. The series-tuned version is shown in Figure 3e; Figure 3f shows the parallel-tuned version. In both cases, the tuning element is a voltage-variable capacitance diode (varactor). In these diodes, the junction capacitance of the diode changes as a function of the applied reverse bias voltage (Vt). In this configuration, Vt is a positive voltage between 0.5 and some maximum limit (+9, +18, +30 or +40 volts depending on the diode).

The voltage-tunable oscillators can be used to make signal generators in which the operating frequency is set by a DC power supply and a potentiometer. Alternatively, the same circuit can be used to make a sweep generator or FM generator, or be used to generate the FM signal in a transmitter.

Signal Generator Project

The signal generator that I needed was a crystal-controlled circuit that would operate on the HF ham bands as well as 10 MHz (for use as a frequency standard). Although I selected an adjustable fundamental mode crystal oscillator similar to Figure 3b, you can use any of the standard oscillator configurations, depending on your own needs. Another requirement for my own signal generator was

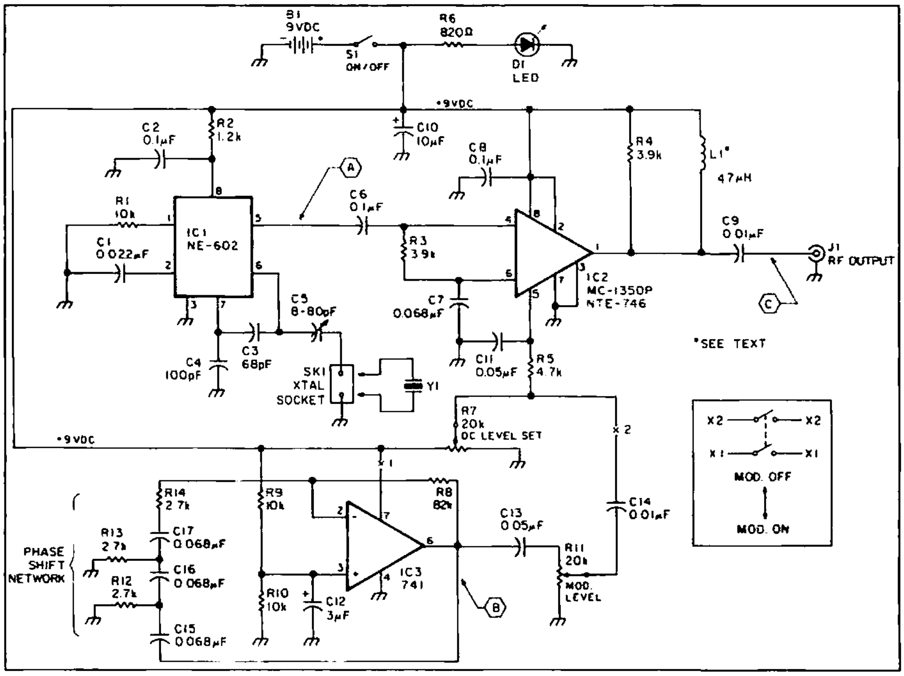


Figure 4. Circuit diagram for the signal generator.

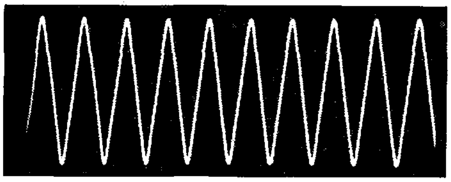


Photo A. Oscilloscope photo of the waveform from the output signal at pin no. 5 (see the circuit shown in Figure 2).

Photo B. Output waveform: RF from NE-602.

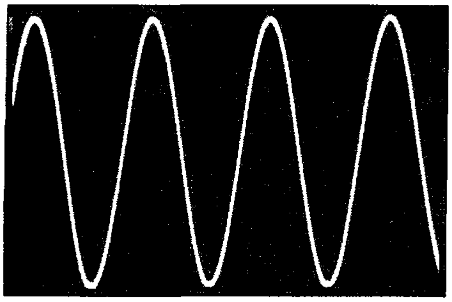


Photo C. Output waveform: AF from 741.

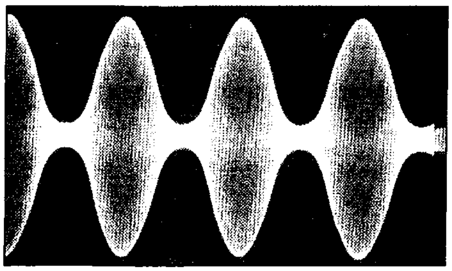


Photo D. Output waveform: modulated RF from MC-1350P.

that it be amplitude-modulated at some frequency between 300 and 1500 Hz (the exact AF frequency was not important). The final circuit is shown in Figure 4.

The crystal oscillator is an NE-602 (IC1) connected in a fundamental mode circuit with a trimmer capacitor for varying the oscillating frequency of the crystals. Because a number of different crystals will be used, and I didn't want to switch them in and out of the circuit (too complex), I used a panel-mounted crystal socket (SK1).

The crystal should be a fundamental mode crystal cut for 3 to 18 MHz operation, and calibrated for 32 pF. Suitable crystals, as well as sockets, can be ordered from a number of sources. Limited selections (with predetermined frequencies) can be found at mail order computer dealers, or the parts houses that support them. But custom (as well as standard) crystals can be ordered from Jan Crystals at P.O.B. 06017, Fort Myers FL 33906; (800) JAN-XTAL; or in Florida, (813) 936–2397.

Integrated circuit IC2 serves as both an output buffer amplifier for the oscillator and an amplitude modulator. It is the MC-1350P (also available as the NTE-746 from

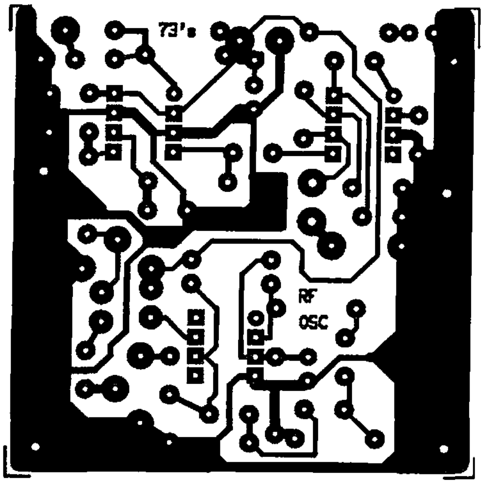


Figure 5. PC board foil pattern.

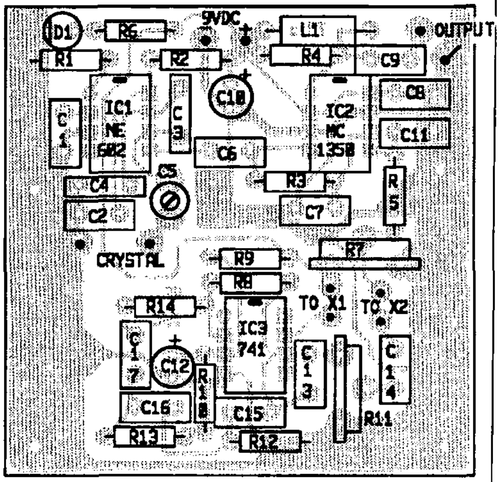


Figure 6. Parts placement.

replacement part dealers), and is billed as an IF/RF gain block. It is frequently used in the IF amplifier stages of FM and communications receivers. It is an 8-pin mini-DIP IC.

This chip is especially useful for three reasons. First, it will operate at the desired frequencies. Second, it is also fairly well behaved, although it seems a little more touchy than the NE-602 device in the circuits that I've tried. This touchiness is probably due to the very high gain that is possible when the output terminal (pin no. 1) is tuned to the input frequency. Third, it has a single terminal that makes it really useful as an amplitude modulator: the AGC terminal (pin no. 5).

The AGC terminal on the MC-1350P is intended for gain control applications. A DC potential applied to this pin will change the gain of the circuit. Two voltages are applied to the AGC terminal in this project: a DC level set by potentiometer R7, and the modulating audio signal. The latter signal is set by potentiometer R11. The DC voltage is normally supposed to be between 3 and 9 volts, so the DC level control is used to set the value at some midpoint that will allow the audio signal to go through positive and negative excursions without exceeding either limit.

The modulating signal is produced by IC3, a 741 operational amplifier connected in the RC phase shift oscillator configuration. Because only a single DC power supply is used, the 741 is operated with a bias voltage applied

Pin. No.	Function
1	Input-A
2	Input-B
3	Ground
4	Output-A
5	Output-B
6	Oscillator Base
7	Oscillator Emitter
8	V+

Table 1. The NE-602's pinouts.

Frequency (MHz)	C1 (pF)	C2 (pF)
0.5	150	2000
1.0	68	470
5.0	45	220
10.0	32	100
20.0	22	50
30.0	18	47
50.0	14	22

Table 2. Capacitor values for oscillator circuits.

to the noninverting input (+IN) through a voltage divider (R9/R10).

The oscillating frequency of the 741 is set by a 180 degree phase shift network consisting of C15, C16, C17, R12, T13 and R14. When combined with the 180 degree phase shift caused by connecting the 741 in the inverting follower manner, the network will produce the 360 degrees needed for oscillation. The oscillating frequency is set by:

$$\text{Equation 3:}\quad F_{Hz} = \frac{1}{2\pi\sqrt{6}\,RC}$$

where R = R12 = R13 = R14, and C = C15 = C16 = C17. With the values shown in Figure 4, the circuit oscillates at a frequency just under 400 Hz. The feedback resistor (R8) should have a value that is at least 29 times the value of R used in Equation 3.

If you want to be able to turn the modulation on and off, then insert the switch shown in the inset to Figure 4 at the points marked "X1" and "X2."

Results

As the old proverb says, the proof of the pudding is in the eating. Photos B, C and D show oscilloscope photos of the waveforms in this circuit. The 10 MHz RF carrier is shown in Photo B (although at a different time base than Figure 2); this signal appears at point "A" in Figure 4. The audio modulating signal appears at point "B," and is shown in Photo C. Finally, the modulated RF signal from the output of IC2 (point "C") is shown in Photo D. 73

Parts List	
IC1	NE-602
IC2	MC-1350P (or NTE-746)
D1	Red LED
Y1	Crystal frequency of your choice
R1,R9,R10	10k resistor
R2	1.2k
R3,R4	3.9k
R5	4.7k
R6	820 ohm
R7,R11	20k potentiometer
R8	82k
R12,R13	2.7k
C1	0.022 µF capacitor
C2,C8	0.1 µF
C3	68 pF
C4	100 pF
C5	8-80 pF variable
C6,C9,C14	0.01 µF
C7,C15,C16,C17	0.068 µF
C10	10 µF/35V electrolytic
C11,C13	0.05 µF
C12	3.3 µF electrolytic
S1	SPST switch
L1	47 µH Digi-Key TK-3922
SK1	Crystal socket
B1	9-volt battery

Misc: Battery clip, case, PC board. A blank PC board is available for $4.50 + $1.50 shipping from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

The Copper Cactus

Continued from page 10

With the help of Bob Post N7KUC, preliminary tests were run in the field. Tom Ring WA2PHW, my friend, just had to try his new MININEC program (written by Brian Beezley K6STI) on the Cactus. Tom is a real pro at building antennas, and the eternal skeptic when it comes to antenna gain claims. He found the patterns pretty close to those described in other tests of similar antennas. That is, a large lobe near the horizon and several radiating at higher angles, on 2 meters. Unfortunately, Tom couldn't get the specs on 440, so we had to rely on field tests. I'm sure the radiation angle is fairly high with the "standard" Cactus, and the gain over a quarter-wave is nil on 440 MHz.

The Double Cactus seems to have a flatter angle of radiation when compared to the standard J design. The SWR curves are fairly flat, usually less than 1.5 to 1 across the band from 145 to 148 and 440 to 450. I have been running both versions of the Cactus J-pole for over two years, and I haven't seen a change in the SWR curves. You should enjoy many years of happy dual-banding with the Copper Cactus. 73

You may write John Post KE7AX at 13263 Europa Ct., Apple Valley MN 55124. Please enclose an SASE if you request information. He gives special thanks to Russ Prince N0DAI, of The Consulting Mac, *and to Bob Post N7KUC and Gary Rogers WR7L.*

73 Review

by Gordon West WB6NOA

The Radio Shack HTX-202 2 Meter FM Transceiver

This full-featured HT is ideal for beginners, as well as for experienced hams.

Radio Shack
700 One Tandy Center
Fort Worth TX 76102
(817) 390-3011
Price Class: $260

More than 7,000 Radio Shack stores nationwide now carry the new Realistic HTX-202 2 meter hand-held transceiver. Priced under $260, sales are expected to be booming for this full-featured, easy-to-operate HT. Radio Shack has been an excellent source for up-to-date study guides for the ham license, as well as offering their popular 10 meter SSB rig. With this new addition to their growing ham radio lineup, Radio Shack now focuses on the no-code Technician Class operators and their need for a quality 2-meter HT.

A Complete Package

The Radio Shack HTX-202 2 meter handheld comes packaged in a colorful blue display box. On the outside of the box, in big print, is printed: "ATTENTION! IT IS ILLEGAL TO TRANSMIT WITH THIS TRANSCEIVER WITHOUT HAVING A VALID FCC AMATEUR RADIO LICENSE OF APPROPRIATE CLASS."

The unit is shipped with a rechargeable nickel cadmium battery, a 100 mA 12-volt DC wall charger, and a snap-open alkaline holder for six 1.25 volt AA cells. The holder is included, but the dry cells are an option.

Also included is a metal belt clip which doubles as a heat sink. It is attached by two tiny screws, held in their own plastic protective pouch. You also get a handy carrying strap which attaches easily to the right side of the transceiver.

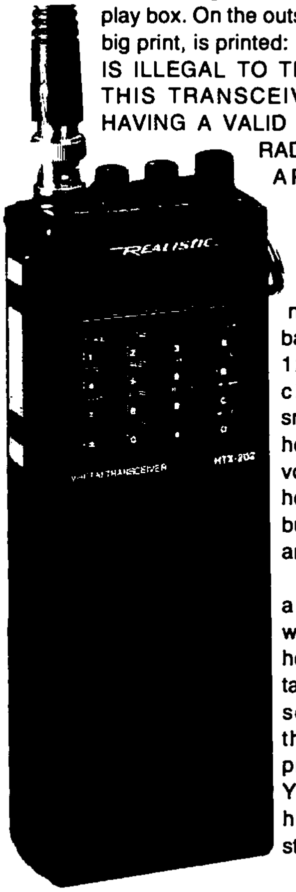


Photo A. The Radio Shack Realistic HTX-202.

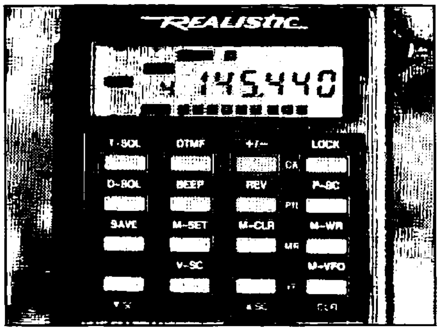


Photo B. The LCD screen is easy-to-read in daylight, but too poorly back-lit for nighttime viewing. The big keyboard makes it easy to push the buttons.

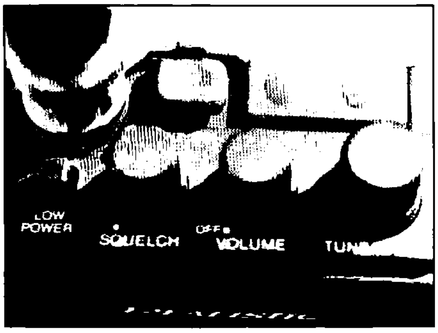


Photo C. Rubber stoppers keep out dirt and moisture.

You will need to charge up the nickel cadmium battery pack before you begin learning to use this new set. The supplied rechargeable pack is rated at 7.2 VDC, with 600 mAh capacity.

On the back of the Radio Shack battery is a little red LED that illuminates when the battery is charging up.

This battery setup is almost identical to the batteries found on the big ICOM HTs, like the IC-2GAT series, and the older IC-02 and IC-2 series. In fact, I found that the BP-2–BP-8 series fit right onto the Radio Shack set, and will power up the Radio Shack unit just as if it had its own battery on. But these batteries are not absolutely interchangeable—the Radio Shack supplied NiCd battery firmly snaps and locks on; the ICOM batteries simply slide on, without actually locking. However, the ICOM base rapid charger will not fast-charge the similar style Radio Shack battery because the pack has no indentations on the bottom. It's best to stick with the wall charger that is supplied with each Radio Shack HT. Even though the ICOM packs fit, they would require their own charger for a quick re-charge.

Power On

When you turn on this 2 meter handheld, you can't help but notice the powerful audio output. The relatively large speaker and good acoustic design make the HTX-202 one of the loudest ones I've ever tested. With a big 12-volt pack on the bottom, we registered over 1 watt of audio output available at the speaker/earphone jack, with two percent distortion. The audio circuit also rolls off any CTCSS tone

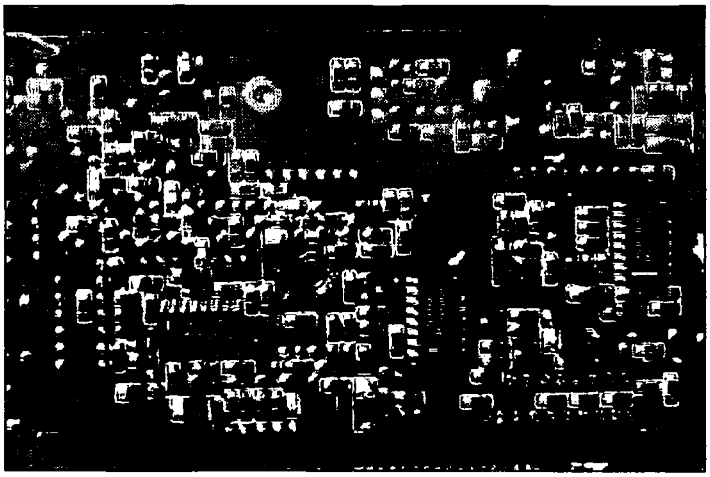


Photo D. SMT technology is used to fit a great receiver into a small HT.

that may ride along with the 2 meter signal. This allows the unit to drive a relatively large speaker without the recovery of PL hum.

The unit powers up from a complete reset on 144.200. This frequency also comes up out of the first memory on a cold start. I'm not sure how the weak-signal gang will appreciate this—an FM power-up smack dab on the national SSB calling frequency. Most sets reset to 146.000 on turn-on. Of course, you can always write over the memorized Channel 1 at 144.200 and the set will come back on to the channel you left it on after an initial power up and QSY. But since the set is going to be sold to beginners, I would hope that they don't think that the memorized Channel 1 at 144.200 is their "home channel," and start using it for simplex operation.

I reconfirmed this by following the reset procedure outlined in the manual: "Press and hold down the function key and the clear key, and then power up the transceiver. It beeps twice, and you're on 144.200, simplex, FM."

Selecting a new frequency is easy with the HTX-202. You can electronically scan up to a higher frequency from 144.200 via the scan up or down buttons. You could also punch in a particular frequency by entering the last MHz number and the remaining numbers. For 146.940, simply press 6-9-4-0 and you are there. You can also manually rotate the tuning knob on the top of the radio to get up to another frequency.

The tuning knob defaults at 20 kHz steps. That's fine for some parts of the country, but out here on the West Coast some of our repeaters are spaced every 15 kHz. No problem with the HTX-202—a simple keystroke gets you into the main menu for presets, and the following defaults are all changeable: duplex offset; TX CTCSS tone; RX CTCSS tone, plus decode off; frequency step; scan resume time; scan delay time; lower scan range limit; upper scan range limit; vacant channel scan direction; power save duty cycle; transmit inhibit; transmit time-out; priority frequency channel look-back time; touch-tone auto reply.

Some pretty interesting stuff here—you can run separate TX and RX CTCSS frequencies, and included in the package is the full encode/decode capability. Be sure to read their addendum sheet that describes how to turn off the decode mute because when you push the tone squelch button on the front, your receiver instantly mutes for full decode. Most folks won't want full duplex or simplex decode, so I suggest you shut down that default option so you can listen with your regular squelch control.

I also liked the capabilities of the four different power save duty cycle sets, and depending how active or inactive your local repeater group is, you can tailor your sample rate just the way you like it. And a transmit time-out timer—great idea in case you should accidentally sit on the remote mike.

Measurements

TX/RX range	144.000 MHz to 148.000 MHz, with no modification available for out-of-band reception due to extremely tight band-pass filtering for superior out-of-band interference rejection.	
Microphone input condenser	1.2K ohms	
Size	2-1/2" wide, 4-1/2" high, 2" deep	
Weight	1 pound, 3 ounces	
Receiver	First IF	21.4 MHz
	Second IF	455 kHz
Sensitivity (12 dB sinad)	0.085 µV	
Squelch sensitivity	0.094 µV threshold, 9.7 dB tight above threshold.	
Spurious response attenuation	81 dB	
Intermodulation attenuation	74 dB	
Adjacent channel rejection	25 kHz, 72 dB	
Audio output power, 10% THD, supplied rechargeable battery		0.39W
Audio output, external 12 VDC		1.2W
Current consumption, stand-by, power save		23 mA
Current drain, stand-by, no power save		35 mA
Transmitter RF output, supplied rechargeable battery		2.8W
Transmitter power output, 9V alkaline batteries		4.6W
Transmitter power output, 12 V DC external		5.6W
Transmitter power output, running car at 13.8 volts DC		6.4W
Low power		1.5W
Deviation measured		4.7 kHz
Frequency error measured		87 Hz high
CTCSS tone deviation		0.49 kHz
DTMF tone deviation		3.94 kHz
TX current drain, supplied rechargeable battery		0.87 amps
Current drain, external 12 V DC source, high power		1.17 amps
Current drain, low power		1/2 amps
Distribution	All Radio Shack stores	
Ease of operation	Friendly, but no auto offsets and buried sub-functions requiring book reading.	
Weather resistance	Rubber stoppers on top, and neoprene O-ring around back heat-sink lip.	
Internal construction	Surface mount technology.	
Memory keep-alive circuit	Lithium battery, minimum 5-year battery, depending on use.	
Accessories	Available at Radio Shack, and some compatibility to ICOM products.	
Most needed improvement	Smooth out PLL performance to eliminate annoying "thunks" in reception.	
Best feature	Extremely hot receiver, with no found birdies or intermodulation or out-of-band interference.	

Scanning and Setting the Offset

When you first get this set, you will probably want to begin memorizing some active repeater frequencies. You can either look them up in a book, and start punching away at the key pad, or scan up and down for activity. You can set your scan limits, and just push the "up" or "down" scan buttons, and away it goes. If you don't change the presets, the scanning receiver will lock onto an active channel, and hold on that channel as you set it up in the menu. It could hold up to 10 seconds, and then go on scanning regardless of absence or presence of the carrier. You can also resume scanning after the carrier drops, and the scan delay time which you preset expires. Or, you can go to the main menu, and go to a scanning stop mode where the unit seeks out a signal, and then locks on and holds, even though the signal disappears.

I found that scanning in 5 kHz steps could sometimes have the unit stop on a repeater prematurely. This is why it's best to set your tuning step range to agree with the local repeater band plan and simplex plan in your particular area. This way, when the scanning stops, you are on channel.

Once you have found a popular repeater, your next step is to access that repeater with the right offset and a subaudible tone. The ARRL repeater directory, or locally published directories, are a handy way to find those favorite repeaters in your local area.

An offset of 600 kHz is the default on this 2 meter unit, so you don't need to go to any trouble to dial this in—it's already there. Just hit the "±" button to come up with the right direction of the offset. The "minus 600" offset is most common in the U.S. on frequencies below 147 MHz, but your first push of the "±" button brings up a plus offset. There are some repeaters above 147 that do take a plus offset, but I was surprised to find that this was the first offset to come up when I pushed the button. Most other handhelds normally start off with a minus offset, the more common offset. If you need an oddball split, you can easily dial in any split of your choice from the menu.

At this point you have a frequency in the VFO, such as 146.940, and you have punched the offset button a second time to get to a minus offset. So far so good. Briefly transmit, giving your callsign, to make sure the unit drops down 600 kHz. Now it's time for the CTCSS tone.

The Radio Shack manual has a nice section on how to program CTCSS for both encode and decode. You input the tone by the exact tone frequency in hertz. This is nice. No more of this business of the number 21 standing for 136.5, etc. If you want tone 4Z, use the book to find out the actual frequency in hertz, get over to the menu for setting different operating parameters, and then cycle over to CTCSS transmit. Next, rotate the top knob for the right encode tone, then cycle to the CTCSS decode function and rotate the top knob so it reads "off." Many repeaters don't output a CTCSS tone so, unless you want your handheld to stay strangely silent, follow the addendum and keep your decode turned "off."

A little "function button" in the upper left-hand corner lets you get at the subfunctions behind the numerical and ABCD keypad. You really have to push hard on it, and this is probably a good thing—you don't want to get into the sub-set mode accidentally.

Now you have the receive frequency, the proper offset, and the proper encode tone; and you have decode turned off and you've selected tone squelch for transmitting the tone. You push the transmit button and sure enough, the repeater comes up and IDs. Give your callsign on the air, and then get ready to store this in your first memory. You want to write over that first memory so you don't ever accidentally transmit FM on 144.200.

Memory Channels

The HTX-202 has 16 memory channels, in three groups. You have one channel for your call frequency, three priority channels, and then 12 additional channels. You can mix and match almost everything within these channels. Unlike older handhelds, what you put in Channel 1 doesn't necessarily lock you into tones or offsets in the other channels.

Memory input is easy—press and hold the function button, and rotate the big knob to the memory channel you want to store. Continuing to hold the function button, go to the channel you want to write into, or write over, and simply press the "C" button, which is the "M-WR" or memory write button. Hold it in long enough for a double beep, and then release the works and push "C" by itself to get into the memory recall mode. Presto—everything you had in the VFO as a repeater "package" is now in your selected memory channel. The only thing that might trip up the newcomer is not holding the memory write button long enough—if you don't hold the button for the double beep the channel won't be written in.

After programming several memory channels, I double-checked to see how everything was going and noticed something very interesting on those memory channels with CTCSS tone on encode. After pushing the PTT button, the transmitter would hang on for approximately a second before cycling off to receive. Same thing on simplex with the tone squelch encode turned on. Possibly the extra hang time gives the operator a little bit more time to start punching in DTMF tone numbers without having to continuously push the PTT button. As soon as I turned off the tone squelch function, the PTT cycle time was identical to PTT pushing time. It almost goes unnoticed, but if you're communicating through a repeater that requires CTCSS, you'll begin to see that your transmit hang time is about a second longer than when you release the push-to-talk button.

In addition to the 12 channels of fully-programmable memory, the Radio Shack HTX-202 transceiver has three additional priority-frequency memories. To get into these memories you push the "B" button instead of the "C" button. A nice feature is the priority check mode. You can set it up so you are operating on a VFO setting for a particular simplex or repeater channel and automatically have the scanner check the priority frequen-

cy memories every four seconds. You can even change the scan time, too.

There is no way to lock a particular memory channel out of the scanning program. Same with priority—once there is a frequency memorized in one of your scan slots, the only way to skip over it is to completely erase it from the memorized lineup. But if your local repeater outputs its PL, you can customize your scanning by turning on your full decode function so that the unit stops only when it detects the right PL outbound tone.

I tried the power saver mode, and it helps conserve the battery if you are monitoring a frequency that has little activity. You can set the power-save setting to four different sample rates during its 1/20 second frequency activity check.

DTMF Capabilities

During transmit, the 16-key pad sends out DTMF tones. The A, B, C, D buttons are also active for control operator functions on certain repeaters. To manually send out the dual tones, push the PTT button, and then punch away at the key pad. You will hear the encoded tones come out of the speaker, too.

> ***"In the pager mode, your unit is absolutely silent until someone dials up your specific five-digit code."***

There are five DTMF memory positions to store up to 15 digits. This is handy if you regularly use your local repeater for autopatch capabilities. Position 1 might be the autopatch turn-on tones, Position 2 might then send out your spouse's phone number, position 3 might be your mother-in-law's phone number, position 4 your Mom and Dad, and position 5 remain available for a friend. Remember, *business communications* are forbidden on the 2 meter band, so you would not store any business phone numbers or ever try to call a business.

A nice feature is the "auto-reply" which is a very strange name for a very common function: the capability to begin manually sending tones, and to release the PTT button and keep punching away at the tones while the transmitter stays turned on. After the last tone is entered, the unit stays on for about two seconds and then drops off TX. I checked to see whether or not this added feature had any bearing on the one-second TX hang time encountered when PL encode was turned on, but I found no interaction.

Touch-Tone Pager

This transceiver also uses the DTMF capabilities as a self-contained pager. You can enter up to five digits for your own private pager code. In the pager mode, your unit is absolutely silent until someone dials up your specific five-digit code. Your unit then jumps up on receive and beeps. You can even set this unit to automatically transmit the dual-tone digit "#," a wild-card universal function, to let the other transceiver know it has successfully triggered your five-digit DTMF code.

Using any 2 meter transceiver as a pager for individual or group calling requires plenty of fun and games with some friends to fully understand the advanced features that more and more 2 meter sets have in this configuration. Run your sets on low power and figure out all the neat things you can do to signal an individual, or a group of friends, using the wild-card function, and getting their sets to transmit back a confirmation tone. You won't find all the details on how to actually do this in anyone's instruction manual—I have read them all, and it's a complex set of keystrokes until you finally get the hang of it. But once you do, your 2 meter set from Radio Shack will easily join in on a system that is already set up using DTMF paging tones.

Overall Impressions

While this is not an over-complicated radio for beginners, it will allow the new Technician class operator to grow into some of the advanced functions found behind the menu setting. Trial and error, plus rereading the instruction manual, will help.

The instruction manual Is short, concise and well-written, and contains only a few errors. (It talks about reversing an offset, referring to the frequency of 146.94, with the input at 146.14. Wrong. It should have read "146.34," as listed properly a few pages later in the duplex separation default section.)

"The ARRL staff helped us prepare this section of the owner's manual, and they would

Continued on page 44

Number 10 on your Feedback card

Colombian Expedition

Adventure in the Andes.

by Milton C. Toby KC4VLN

Operating mobile anywhere can be tricky, and most hams are familiar with the usual technical and logistical problems and solutions. In Colombia, South America, mobile operation presents some unique hazards as well: police roadblocks, guerilla warfare, and having your identity and intentions suspect. The deserted gravel road turns out to be deserted because one of Colombia's alphabet soup guerrilla groups is using it. The antennas sprouting from the roofs of your two-car caravan arouse suspicion that you are "narcotraficantes."

There are also unique rewards in operating from this exotic location. During one four-day trip we were able to share the magic of amateur radio with students at two rural schools high in the Andes Mountains. At another time we chatted with a small but dedicated group of amateurs in the United States who were tracking our progress.

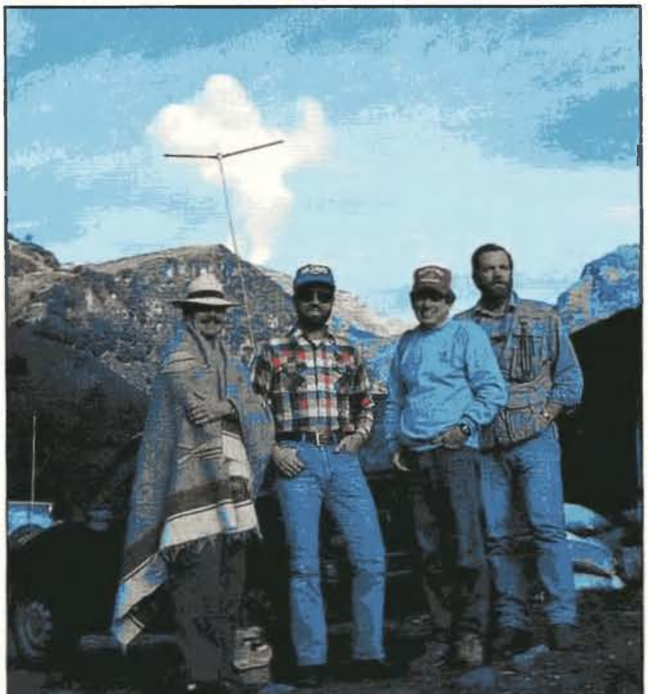


Photo A. L. to R.: Phil KI6SA/HK3, Jim HK3AVR, Roy N7KLH/HK3, and Milt KC4VLN, with Nevado del Ruiz volcano in the background.

Making Quality Contacts

The trip to Colombia was not a DXpedition in the classic sense of the word. At the time, everyone in our group—Phil KI6SA/HK3, Jim HK3AVR, Roy N7KLH/HK3, and Milt KC4VLN—was living in Colombia. Also, Colombia is not really a rare DX country, and we did not set out to make hundreds or thousands of contacts. Instead, we wanted to have a few quality QSOs, longer chats that would give us the opportunity to share with other amateur operators a little bit of Colombia. The country has much more to offer than drugs and violence, and our trip was an excuse to tell that to people whose perceptions of the country might have been formed solely by Miami Vice reruns.

Photo B. L. to R.: Bishop Jose Luis Serna, a new amateur radio operator; a student at the Murrillo school, the Colegio Francisco Jose de Caldas; and Phil. The kids at Murrillo chatted with the kids at Longwood Middle School in New York for almost an hour.

We also wanted to shrink the world a little for some Colombian school children, giving them the chance to talk with kids in the States. We wanted to operate from the ruins of Armero, then climb Nevado del Ruiz, the volcano that erupted and buried the town in 1985. We wanted to transmit from as near the summit as we could get, and we wanted to try operating with a kite-borne antenna system sometimes used by the Colombian Red Cross.

Overall, we did pretty well. The kite project literally never got off the ground, but everything else worked more or less as planned. We negotiated the roadblocks with no problems, avoided the guerrillas, and were able to make a number of the kinds of contacts we were hoping for.

Murrillo

Our first stop was in Murrillo, a town of some 1,500 people high in the rich coffee country several hours' drive west of Bogota, the capital of Colombia. Murrillo's school, the Colegio Francisco Jose de Caldas, has 200 students of all ages, and they all seemed to be waiting in the schoolyard for our arrival. During a QSO with Len WA2LLG the day before, he had sugested we try to contact the Longwood Middle School in New York, where there is an active radio club operating on 10 meters most days.

Len handled the advance work for us through his contacts at the Longwood School, and the students there were ready with questions when we established contact. The first question for the Colombian kids, predictably, was about Juan Valdez and his burro. But the successful ad campaign to promote Colombian coffee in the United States is not seen in Colombia; they did not know of Juan Valdez. Their experience with coffee was more immediate. While they talked to the States, two groups of coffee-laden burros led by the real-life counterparts of Juan Valdez passed the schoolyard.

With several different people acting as translators, the kids in Murrillo chatted with the kids in New York for almost an hour. They exchanged information about their schools, geography, and respective hometowns. For a while the Andes and Long Island were a lot closer than a map might suggest.

In the afternoon we drove farther up into the mountains, to the Escuela Rural Mixto "Santa Barbara" at 11,100 feet. A tiny school with perhaps 30 students, the Escuela "Santa Barbara" was closed the day we were there, but 15 students showed up anyway for our radio demonstration. With a dipole in the schoolyard we made a brief contact with Spain, then worked Marty HH5MV in Haiti for more than a half hour. Fluent in Spanish and English, Marty was a perfect contact for the few kids who were brave enough to talk. Pedro Valencia, a ruddy-faced four-and-a-half-year-old, was the least intimidated, and after just a little prodding, he worked Haiti like a pro.

Photo C. Pedro Valencia, four and a half year-old student at the Esçuela Rural Mixto "Santa Barbara," talks to Marty HH5MV in Haiti.

The visits to the two schools were arranged for us by Bishop Jose Luis Serna, head of the Catholic Church in Tolima Department, and a brand new amateur radio operator. We spent two nights at the bishop's house—a renovated hospital in Libano where, during an earlier trip, Phil had helped the Bishop get his modest shack operational.

The equator bisects Colombia a little south of Bogota, but the country is not always the tropical paradise geography might suggest. Three chains of the Andes Mountains run through Colombia, and the weather is more a factor of altitude than latitude. Several volcanos are in the 5,000 meter (16,000-plus feet) range and it was one of those snow-covered volcanos, Nevado del Ruiz, that a few years ago erupted and caused one of the worst disasters in Colombia's history.

Armero

On the night of November 5, 1985, after most of Armero's 50,000 residents had gone to bed, Ruiz erupted. It was not a major eruption, but the hot gases melted most of the volcano's snow cap, and a swollen river of mud and rocks roared down into a valley on the mountain's eastern slope. Twenty miles away, at the foot of the mountains, the valley opened onto Armero. The town vanished under a sea of mud, and 20,000 people lost their lives.

Today, Armero is deserted. The second floors of a few wrecked buildings jut out through the dried gray mud, and hundreds of white crosses dot the landscape, silent reminders of the people who died there almost six years ago.

We arrived in Armero in the afternoon, with the temperature and humidity both in the 90s. We managed to make a few contacts, mostly on 10 meters, before fleeing the heat. A few of the people we spoke with had some vague recollection of the disaster, usually through photographs on the covers of news magazines, but no one realized the extent of the damage or the number of lives lost.

Nevado de Ruiz

We left for Ruiz early the next morning, and our first glimpse of the volcano was one of spectacular beauty. Climbing into the mountains, we rounded a sharp bend in the road, and in front of our cars was Ruiz. Its snow-covered peak was bathed in warm morning light, a glowing jewel among the shadows. As we climbed higher and got closer to Ruiz, we crossed the valley where six years earlier a churning wall of water had destroyed everything in its path. Some vegetation was starting to grow again, but for all practical purposes the valley was dead, just like Armero.

Ruiz lies in a national park that for several months had been closed to the public because of fear of another eruption. As we approached the park, we could see clouds of smoke and steam rising from Ruiz' crater, and we wondered how close we would get. We planned to operate from as near the top as we could, which meant driving in as far as possible, then proceeding on foot. But first we had to get into the park.

Colombia's bureaucracy is average by Latin American standards, but maddeningly inefficient when seen through the eyes of a group of gringos. We had started the paperwork needed to get park permits weeks in advance, and we had been assured that everything was in order, but when we arrived at the lone park gate, the guards had absolutely no idea who we were.

A radio call to the park authority offices in Manizales, a day's drive away, yielded little. But there was one peson who thought he remembered hearing something about someone who wanted to take some radios into the park. It was not much to go on, but it was enough for the guards. The responsibility for our visit was not theirs anymore, and they sent us on with their blessings.

We were still in two vehicles, a Mitsubishi Montero four wheel drive that was well-suited to the ever-worsening road, and a tiny Chevrolet Sprint that was bottoming out on every rut and struggling in the thin air. We abandoned the Sprint at 14,200 feet, piled as much radio gear as possible into the Montero, and pressed on to 15,400 feet and the end of the road.

We continued operating on the ride up the mountain, making contact with several hams who had been following our trip since the start. Thin air and occasional bouts of car sickness reduced our efficiency, and when we started mixing up our own callsigns during the QSOs, a couple of people asked if we had supplementary oxygen. In retrospect, that might not have been a bad idea.

We established a base camp of sorts at the remains of a lodge at 15,500 feet that had been destroyed by the 1985 eruption. Then three of us decided to climb higher while Phil tried to get our portable rig, an HR-2510, up and running. Roy and I stopped at 16,000 feet, while Jim made it to the edge of a glacier at around 16,500 feet. The summit of Ruiz was in sight, but out of reach at nearly 17,180 feet. We turned back when a small eruption showered us with fine ash and sulfur fumes.

We never were able to get the HR-2510 working. With clouds rolling in and the temperature dropping below freezing, we abandoned the ruined lodge and started back to the cars. We reestablished contact with the States again from the car's radios, and although the HR-2510 failure was a disappointment, we were able to make several contacts from nearly three miles high on the volcano's slopes.

We could have tried flying our kite antenna from Ruiz—there certainly was enough wind—but the bad weather and thin air dampened our enthusiasm. The next day, during the drive back to Bogota, we tried to get the kite in the air. The experiment turned into a kite fiasco, with the kite repeatedly crashing to the ground after a few seconds of flight.

It is a safe bet that few of the Colombian school children we visited ever will have the chance to visit the New York kids they talked to, and most of the amateurs from the States who tracked our progress up the volcano will probably never visit Colombia. But because of the magic of amateur radio, they won't have to. In a very real sense, they have already made those trips.

Milton C. Toby KC4VLN, 712 Lebanon Avenue, Campbellsville KY 42718.

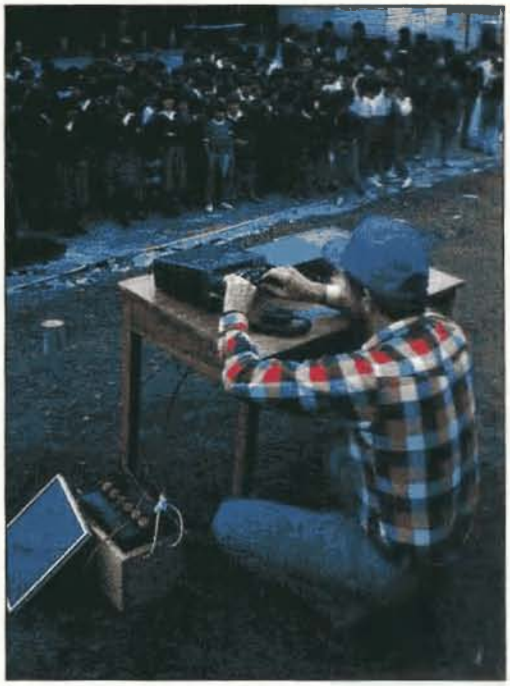


Photo D. Jim HK3AVR demonstrates amateur radio to the students at the Murrillo School.

PVC Cubical Quad for 10 Meters

Build this $30 plumber's special!

by Wayne Mishler KG5BI

The station calling "CQ" at 28.375 MHz from Yugoslavia was out in the open and coming in S-5. I keyed the mike and called him. There was a moment of silence. Then, in broken English, he said, "Q R Zed. Station calling. You are very weak. Please try again."

I complied. No response.

Then I heard another local ham call him, and the YU came back to that guy with a 5-9 report.

For a moment, I sat staring at my transmitter, wondering what was wrong. Then I heard my competition say that he was using a directional antenna. Mine was a dipole. I felt an antenna project coming on.

In the past, I had experimented with quad antennas for 2 meters. I still had the data for those antennas, which had produced considerable gain with good front-to-back ratio and workable standing wave ratio (SWR) at the feedpoint. So I put pencil to paper and came up with the dimensions for a monobander for 28 MHz.

Much of the data came from the *ARRL Antenna Book*, 14th edition, and the book *All About Cubical Quad Antennas*, coauthored by William Orr W6SAI and Stuart Cowan W2LX.

Construction

For several reasons, I decided to use Schedule 40 PVC and wood dowels in constructing the antenna. These materials are readily available at hardware stores. They are transparent to RF, easy to work with, and resistant to weathering. (I gave the dowels that would be exposed to weather three coats of an oil-based enamel.) And the price was right. All of the materials, including antenna wire for the elements, cost about $30.

I made the boom and mast from a single 10-foot length of 1-inch PVC cut into three pieces (see Photo A and Figure 1): 1-foot, 3-feet, and 6-feet long. To make the boom, I

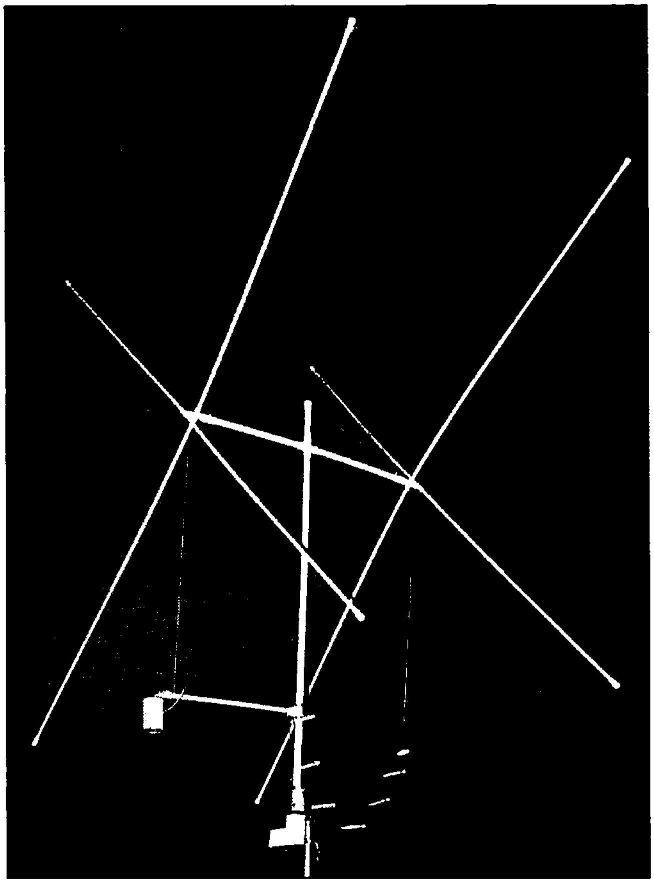


Photo A. The flexible PVC cubical quad has withstood thunderstorms and 60 mph winds.

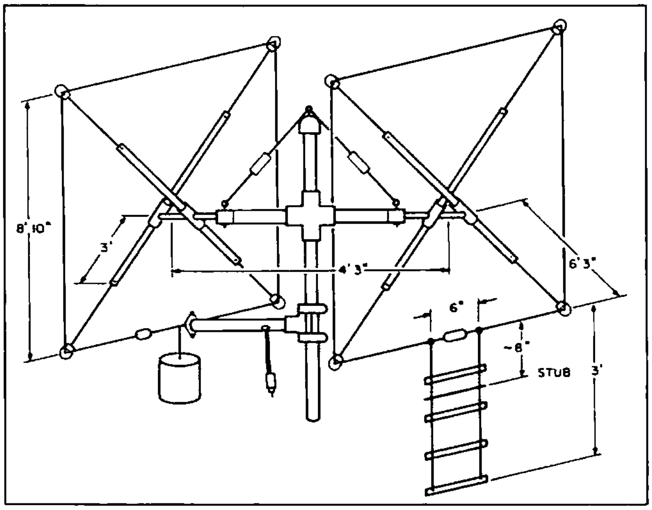


Figure 1. Layout and dimensions of the cubical quad.

cut the 3-foot piece in half. Using PVC cement, I glued the resulting two 18-inch pieces into opposite ends of a 1-inch PVC four-way cross fitting.

I made the mast by gluing the 1-foot and 6-foot pieces into the remaining ends of the cross fitting. The purpose of the 1-foot length of PVC at the top of the mast is to provide support for the boom. Nylon string connected from the top of that piece to the spreaders helps keep the boom from bending downward.

To keep the bottom of the PVC mast from collapsing when clamped into a rotor, and to provide vertical rigidity for the mast, I inserted 1-inch dowels all the way through the mast, cross fitting, and top support piece.

At first, the dowels were slightly too big to go into the PVC. A power sander solved this problem.

Next, I drilled a hole in the center of the top of a 1-inch PVC cap fitting and installed a 3/16" x 2-1/2" eyebolt to serve as a tie-point for the nylon string that would support the ends of the boom. I then glued this cap onto the 1-foot support piece at the top of the mast.

Spreader Supports

PVC fittings hold the spreader arms (see Photo B). Both spreader supports are made the same way. Begin with a 1-inch PVC coupler fitting. Using PVC cement, glue a reduction adapter for 1/2-inch PVC pipe into the coupler. Then glue a short (1-1/2-inch) length of pipe into the adapter. Glue a cross fitting onto the exposed end of this pipe. Next, glue another short length of pipe into the opposite end of the cross fitting. Finally, glue the base of a "T" fitting onto the exposed end of this pipe and *immediately* rotate the "T" fitting until it is at right angles with the cross fitting when viewed from the end. With this last step, you'll have to work fast, because the glue sets up quick-

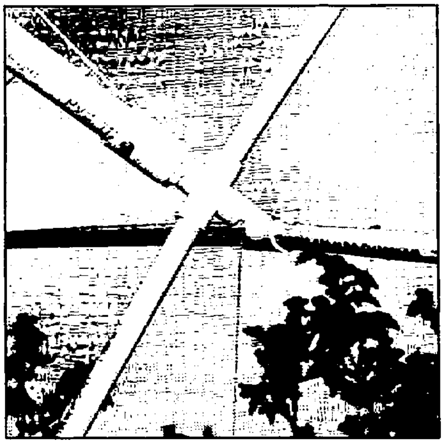


Photo B. The spreader arms, which are half PVC pipe and half wood dowels, fit into PVC fittings. The fittings are linked together with short lengths of 1/2-inch PVC pipe and glued with PVC cement. A "T" fitting is connected to a cross fitting which is connected to a 1-inch coupler fitting by way of a 1/2-inch adapter. The coupler fitting slips over the end of the boom, and is held in place with an eye bolt.

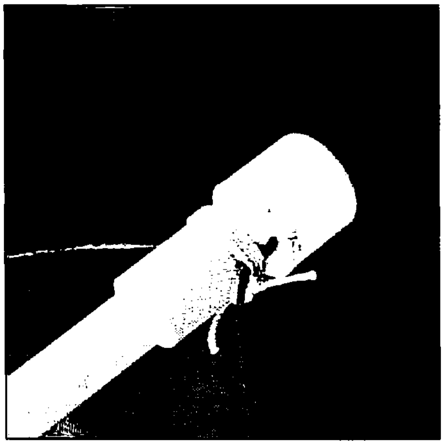


Photo C. The tips of the spreader arms are made of 1/2-inch PVC pipe, capped and drilled to accept the wire elements. The nylon string keeps the wire from slipping.

ly. Repeat the process to make the other support.

Adding Spreaders

To simplify construction, I made both elements the same size and lowered the frequency of the reflector with a tuning stub.

Begin by cutting eight 3-foot long pieces of 1/2-inch Schedule 40 PVC pipe. Insert and glue these into the fittings of the two spreader support assemblies, so they form an "X" when viewed from the end.

Select eight 4-feet long, 5/8-inch hardwood dowels, and paint them with a quality oil-base enamel. Give each dowel three coats, allowing each coat to dry at least overnight.

When the last coat of paint has dried, insert a dowel into one of the PVC spreaders until the total length, from the tip of the dowel to the center of the spreader support assembly (axis of the boom), measures exactly 6'3". Anchor the dowel to the PVC by drilling a 1/16-inch hole through the PVC into the wood, and screwing into this hole a #6 1/2-inch sheet metal screw. Repeat this process for the remaining seven spreaders.

To make tips for the spreaders, which hold the wire elements in place, cut eight pieces of 1/2-inch Schedule 40 PVC, each three inches long. Glue 1/2-inch PVC caps over one end of each piece. Next, using a 1/8-inch drill bit, drill at right angles through each pipe at the base of the cap.

Assembling the Elements

To assemble the reflector element, lay one of the completed spreader assemblies flat and place the tips on the ends of the dowels. Thread antenna wire through the holes in the tips. Each loop has a circumference of about 36 feet, so plan accordingly. After you have threaded the wire through all four tips, bring the wire together in the center of the bottom side of the loop, pull it snug, make sure that the spreaders are straight, and connect the two ends with an egg insulator. The ends of the reflector loop must be insulated from each other. Finally, wrap nylon string around the

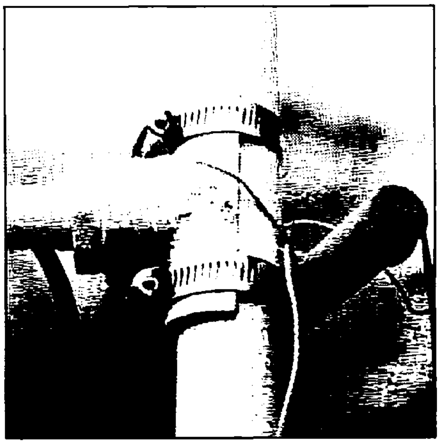


Photo D. The feedline support is attached to the antenna mast by a 1-inch "T" fitting. The top of the fitting has been hacksawed away to fit against the mast. Hose clamps hold the fitting in place. A reducing adapter glued into the base of the fitting accepts the 1/2-inch support pipe. The feedline enters the pipe through a hole in the bottom and screws to the SO-239 chassis connector at the other end of the pipe. The dowel at right is the end of the tuning stub, tied to the mast.

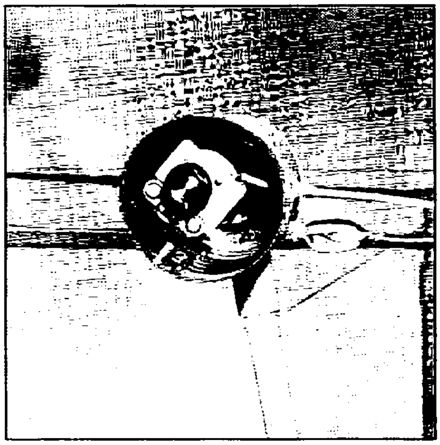


Photo E. A coffee can houses the matching capacitor. One side of the capacitor is electrically connected to the can; the other side to the driven element by an insulated wire through a grommeted hole in the can. A bare solid wire bolted to the top of the can is soldered to the center contact of an SO-239 chassis connector (out of view). A plastic lid that came with the can normally covers the opening, sealing out weather and insects.

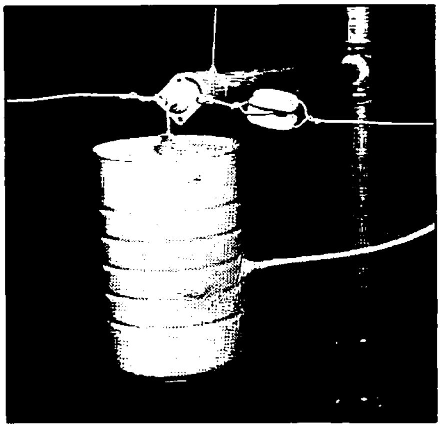


Photo F. The coffee can feedpoint is supported by a 1/2-inch PVC pipe through which passes the 50 ohm coax feedline. Note how the SO-239 chassis connector is rigged. One end of the driven loop is soldered to the left corner of the connector base. The other end of the loop is supported by, but insulated from, the opposite corner of the connector base. A wire bolted to the can is soldered to the center contact of the connector. The holes in the can have been sealed with silicon sealer, and the outside painted to prevent rust.

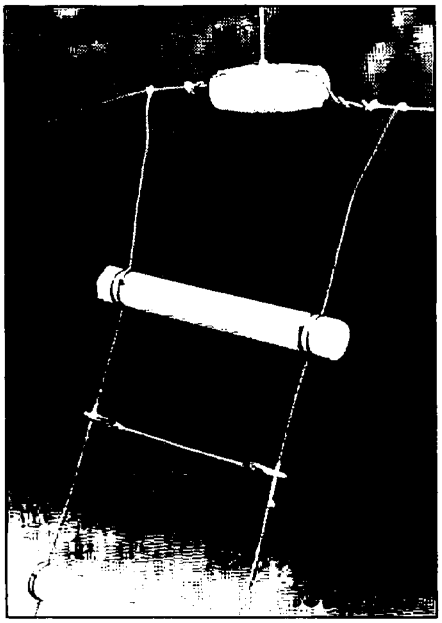


Photo G. The tuning stub is soldered across the insulator in the reflector loop. The wires of the stub are held 6 inches apart by wood dowels with holes drilled in the ends. The wires are tied to the stubs to keep them from slipping. Note the shorting bar, which is a length of solid wire with copper alligator clips soldered to the ends. After being adjusted, the bar is soldered to the stub wires. The string tied to the insulator keeps the bottom of the reflector loop from sagging.

tips of the spreaders and the wire, to keep the wire from slipping (see Photo C).

The completed element will seem floppy. Don't be concerned. Mine held its shape nicely after I raised the antenna to a vertical position.

The process for making the driven element is identical, except for the insulator. Instead of installing an egg insulator at the bottom of the loop, temporarily connect the ends of the wire together. You will add a feeder assembly at this point after erecting the antenna.

Final Assembly and Installation

Suggestion: Get a buddy to help you with this step. I didn't, and ended up doing a dance and balancing act that would have made an acrobat proud.

First, make sure that there are no power lines within reach! Place the elements on the boom. Adjust them until they are square with the mast, with the bottoms of the loops positioned so they will be toward the ground when the antenna is raised.

Fasten the elements to the boom with 3/16" x 2-1/2" eye bolts instead of glue (you may need to disassemble the elements later). Drill holes for the bolts through the coupler fittings and the boom. Install the bolts with the eyes at the top. They will serve as tie-points for the nylon string boom supports.

Rig two nylon strings from these eye bolts to the one in the top of the mast. Two small turnbuckles installed in the center of each string will make it easier to adjust the tension.

Prepare to mount the antenna in the rotor. Yes, you will need to rotate this antenna; it is very directional. I used a Radio Shack television rotor mounted on a section of steel television mast, because this is what I happened to have in the junk box.

Make sure the rotor is low enough for you to reach the bottoms of the element loops after the antenna is erected. Then, preferably with the help of a friend, hoist the antenna and clamp the base of the mast into the top of the rotor. Make sure everything is straight, and that the antenna is correctly oriented with the direction of the rotor at the time of installation. Tighten snugly.

Feeder Assembly

In order to achieve a workable SWR, you will need to feed the driven element through a capacitor. This is easy to do, using an air variable capacitor, a coffee can, and an SO-239 chassis connector.

First, make a support to attach the feeder assembly to the antenna mast. Start by cutting the top off a 1-inch PVC "T" fitting. Glue a 1/2-inch adapter into the base (uncut) end. Place the altered fitting on the mast, with the adapter pointing at the center of the bottom of the driven element loop, and fasten in place with hose clamps (see Photo D).

Cut a piece of 1/2-inch PVC pipe about 30 inches long, and glue one end into the fitting. Loosen the clamps and slide the fitting up or down so that the pipe touches the bottom of the loop at the center. Cut the pipe 1 inch short of where it touches the wire, and glue a 1/2-inch PVC coupler fitting over the cut end. Bore a 3/8-inch hole in the *bottom* of the pipe at the point where it enters the "T" fitting near the mast, to accommodate coax.

Next install an SO-239 *chassis connector* in the loop where the two ends of the wire come together. Cut both wires where they meet. Insert one of the wires through one of the holes in the base of the chassis connector (the ground part), and secure by twisting the wire around itself. Solder this connection. Connect an egg insulator to the opposite corner of the connector, then fasten the other end of the loop to this insulator. Thus, one end of the loop connects directly to the base of the chassis connector, the other to the insulator. The ends of the loop must be insulated from each other.

Cut a piece of 50 ohm coax 4 feet long and install an PL-259 plug to one end. Screw the installed plug onto the chassis connector. Thread the other end of the coax through the PVC pipe support and out of the hole near the mast. Install a PL-259 plug on this end of the coax.

Drill a hole for a 6-32 x 1/2" machine screw in the center of the bottom of a coffee can. Be sure to save the can's plastic cover. Using a lock washer, insert the screw from inside the can, so the threads protrude outward. Turn a nut onto the screw and tighten firmly.

Cut a piece of bare, solid 14-gauge copper wire 3 inches long. Form one end into a loop just big enough to slip over the screw. Bend the wire 90 degrees about 1 inch from the loop. Slip the loop over the screw. Place a washer and nut over the loop and tighten securely. Bend the opposite end of the wire 90 degrees, about 1 inch from the end.

Mount an air variable capacitor (use a capacitor with at least 1.16" plate spacing and a 100 to 400 pF maximum value) inside the can, with the rotor shaft pointing outward (so you can reach it). See Photo E for details. Make sure the rotor shaft and insulated knob are completely inside the can, so the plastic cover will not touch them. Set the capacitor in a fully meshed position (maximum capacitance). Electrically connect one side of the capacitor to the metal can. Solder an *insulated* wire 12 inches long to the other side of the capacitor. Pass this wire through a grommeted hole in the side of the can.

Solder the wire that is bolted to the top of

Table 1. SWR Curve

Frequency	SWR
28.0	2.0:1
28.1	1.6:1
28.2	1.3:1
28.3	1.3:1
28.4	1.6:1
28.5	1.8:1
28.6	2.1:1

Table 2. Parameters for the 10M PVC Cubical Quad

Operating frequency (in MHz)	28.40
Element spacing (in feet)	4.16
Circumference of element loops (in feet)	35.39
Dimension of one side of loop (in feet)	8.85
Length of one spreader arm from tip to boom axis (in feet)	6.26
Length of mast to boom axis (in feet)	6.00

Parts List

Quantity	Item	Source
1	1" x 10' PVC pipe	Hardware store
3	1/2" x 10' PVC pipe	Hardware store
1	1" PVC cross fitting	Hardware store
1	1" PVC "T" fitting	Hardware store
2	1" PVC coupler fitting	Hardware store
3	1" to 1/2" PVC adapter	Hardware store
1	1" PVC cap fitting	Hardware store
8	1/2" PVC cap fitting	Hardware store
2	1/2" PVC cross fitting	Hardware store
2	1/2" PVC "T" fitting	Hardware store
1	1" x 4' dowel	Hardware store
1	1" x 3' dowel	Hardware store
8	5/8" x 4' dowel	Hardware store
2	Small turnbuckles	Hardware store
8	#6 x 1/2" sheet metal screws	Hardware store
3	#6 x 1/2" machine screws	Hardware store
1	#6 lock washer	Hardware store
6	#6 washers	Hardware store
6	#6 nuts	Hardware store
3	3/16" x 2-1/2" eye bolts	Hardware store
1	Tube silicon sealant	Hardware store
1	Roll nylon string	Hardware store
1	Can spray paint	Hardware store
1	Can oil-base enamel	Hardware store
80'	Antenna wire	Radio Shack
2	Egg insulators	Radio Shack
1	SO-239 chassis socket	Radio Shack
2	PL-259 coax plugs	Radio Shack
4'	50 ohm coax	Radio Shack
1	Large air variable capacitor, 100 to 400 pF maximum.	Radiokit #21140 or 284130 are possible candidates.

Contact Radiokit at (603) 635-2235 or write P.O. Box 973, Pelham NH 03076.

the can to the center point of the chassis connector. Then solder the loose end of the insulated wire from the capacitor to the end of the driven element loop near the insulator. Put the plastic lid over the bottom of the can, seal all holes, and spray paint the outside of the can to prevent rust (see Photo F). *[Ed. Note: You can eliminate this capacitor feed arrangement and hook your coax directly to the driven element. However, if you are unable to obtain a very good SWR reading, you should use an antenna tuner in the shack or use the antenna mounted capacitor as described above]*

Tuning The Antenna

The tuning stub consists of two pieces of bare, solid 14-gauge copper wire 3 feet long, held 6 inches apart by dowel spacers (see Photo G). The shorting bar is a piece of bare solid wire with copper alligator clips soldered to the ends. Temporarily clip the bar to the stub about 6 inches from the reflector element.

Adjust the shorting bar on the tuning stub for maximum front-to-back ratio on receive, by moving it toward or away from the reflector element. Then adjust the capacitor for minimum SWR, using low power, with the SWR-meter placed at the input of the antenna. When finished tuning, solder the shorting bar in place.

My minimum SWR at maximum front-to-back ratio was 1.3:1 at 28.250 MHz. By moving the shorting bar closer to the reflector loop, I was able to achieve a 1:1 SWR, but with equal front-to-back signal strengths. I adjusted the stub for maximum difference between front and back, and then adjusted the capacitor for lowest SWR at the optimum stub setting. At this setting, the band width between SWR 2:1 was 600 kHz.

Operation

On the air, I couldn't believe my ears. I tuned in a California station calling "CQ." He was S-9 plus 10 off the front of my quad; only S-3 on my dipole. I gave him a call. He gave me an S-9 report. I rotated the antenna to the east. He dropped to S-5 and verified that my signal did likewise. I turned the antenna back to the west, and he went back to S-9 plus. When I switched to the dipole and transmitted, he could barely hear me.

But Will It Survive?

The next day, we had 45 mph winds. The flexible PVC bent and swayed, but did not break. There was no noticeable change of SWR in the wind. To date, the antenna has survived several thunderstorms and winds of 60 mph with no damage.

From my QTH in north Texas, the quad has enabled me to work with ease Australia, Columbia, Ireland, Hungary, Italy, Japan, Venezuela, Russia, Costa Rica, Argentina, and Germany. Since putting it on the air, I've yet to hear "Q R Zed" on 10 meters. But if I do, you can bet I'll be able to work him. ■

Contact Wayne Mishler KG5BI at 2812 Olympia Drive, Arlington TX 76013.

Radio Shack HTX

Continued from page 33

be glad to hear from you if you need more information, or if you would like to join," is the comment in the first part of the book. A page and a half is devoted to the legalities of running this unit with the proper Technician Class license or higher. The League official who wrote this section did a nice job of making it absolutely clear that there is no problem with owning a set and using it on receive without a license, but to transmit you must have a current Technician Class license or higher.

For the beginner operator, the little rough spots in the operation of the set will probably go unnoticed. However, to the seasoned 2 meter ham, the most noticeable "bump" in the relatively smooth-operating receiver is the "thunk" every time a keystroke is entered for frequency selection, and the unmistakable quick-drop of the PLL circuit every time you manually rotate the top knob up or down the band. In fact, the receiver drops out completely—even on open squelch—if you rotate the top knob too quickly searching for signal activity. I like to manually spin through the frequencies, looking for activity, but on the HTX-202 if you do this too rapidly you'll zip right by someone transmitting just feet away. It's also annoying to have the receiver gate each time you are homing in on a signal in the 5 kHz step mode. Every time you rotate the top knob the receiver goes "thunk." This is confirmed visually by the drop-out of the signal strength indication and the busy LCD prompt each time you rotate one click on the top knob.

But what a receiver! I took the HTX-202 to several areas of intense high-band RF saturation and it outperformed every other handheld receiver around for sensitivity, selectivity and out-of-band rejection. I couldn't believe I was listening to the audio out of a handheld! Ed Juge W5TOO of Radio Shack is absolutely correct: This receiver, on a big outside antenna or a little rubber ducky, may outperform much larger mobile units for out-of-band signal rejection.

The little green illumination behind the LCD screen was not good enough for easy viewing of the center of the display at night. Two little grain-of-wheat bulbs at each end of the screen are just not enough for a screen this large. During the daylight, the LCD numbers and prompts were adequately clear.

On the top of the unit are jacks for a speaker, mike, and 12-volt DC input. My ICOM and Yaesu hand-held remote microphones plugged right in and worked great with the HTX-202. I plugged the unit into my TNC, and the levels were fine. Switch time was just like my other handhelds until I engaged CTCSS encode. This caused the transmitter to hang for that one additional second.

The 12-volt plug uses the more-common positive center connection. There is a little diagram on the top of the unit, too. I am glad Radio Shack stayed with the center positive because the recessed center receptacle keeps your 12-volt DC cord from accidentally shorting out when it bangs against something metal on your vehicle. And, as with all handhelds, if you have an aggressive alternator you may need to install a series alternator line filter to keep the noise out of your transmitted and received signals.

A little rubber plug assembly keeps everything covered up when you are not using the accessory jacks on the top. It also gives the traditional BNC-type rubber ducky a nice tight fit when you screw it on top of the HT.

The published specifications agree with the performance of the transceiver. In some cases, the transceiver did a little bit better than the specs. And, while it's important to review published specs, there is no better test of a 2 meter walkie than to take it up close to a repeater site and see whether or not the receiver continues to perform. On this set, receiver performance was excellent except for the "thunk" of the PLL circuit and the typical low-cost squelch circuit that either chops on, chops off, or chatters at a marginal signal.

For the beginner or seasoned ham, the HTX-202 is a terrific value in performance and included encode/decode/pager features. Its straightforward operation can be figured out easily, even without the instruction book, for basic frequency entry. It takes some time to get into the menu to find the encode capabilities, and to turn off the decode function that immediately clamps the receiver when you engage tone squelch, but a few seconds of reading the book gets you on the air quickly.

This is Radio Shack's first 2 meter handheld, and they did a remarkable job to get it out in the marketplace for under $260, an almost unheard of price for a full-featured 2 meter hand-held transceiver.

Number 12 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
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Kids Are Talking

One day, three years ago, Gordon West WB6NOA and I were on 10 meters discussing ways to get more youngsters on the air. We found ourselves in a pile-up with other hams who agreed it would be a great idea to get schools across the country all linked up on 10.

So began the CQ All Schools Net every Tuesday and Thursday. Gordon and I are always encouraging teachers to get their students on the air with other kids all over the world. It's simply one of the most exciting ways to spark children's interest in their world. Please remember to join us at 17:30 UTC on 28.303 MHz.

Gordon West WB6NOA
Guest Editorial

Hand the mike over to a student and hear the excitement as they say their name and QTH over the airwaves. It is this type of live amateur radio demonstration that makes for a very lasting positive impression of what ham radio is all about. Remember the first time you talked over the ham radio mike?

You can see the excitement in every one of Carole Perry's students when she hooks up with a new station on the CQ All Schools Net and puts another young student on the air for the first time. "You should see their faces light up when it's their turn to talk!" she says.

You should *hear* the excitement of those students on the air at the other end of the circuit! And thanks to over 400 10 meter transceivers donated by Uniden in a "Schools on 10 Meters" program inaugurated by Don Stoner of National Amateur Radio Association, kids all over the country are catching the excitement of what ham radio is all about.

But whether you're teaching a class for kids or adults, you will need plenty of "props and gags" to keep your teaching program *exciting*.

There is nothing worse than watching a video with "talking heads." Wouldn't it be boring to watch the news and never see any live reports from the scene? And wouldn't it be dull to teach an evening ham radio class and never give your students anything more than talk, talk, talk?

As an example of "ham radio demos and gags" that students always seem to remember, here are some of my best demonstrations as they relate to the nine FCC topic areas of amateur radio licensing. These can work in any grade class—from Novice to Extra!

Rules, Regulations, and Operating Procedures

I play a tape recording of an actual amateur radio emergency call from a sinking boat. I have students tune into the airwaves and identify CW, RTTY, and packet. I have students operate third party. I show them an actual Notice of Violation and have them look up FCC rules after I give them an FCC Part 97 section number.

I tune a radio into signals, and have everyone write down the Q codes they hear, and the meaning of those Q codes. I let students rate RST signal reports from transmissions they hear over the air. I tune into a repeater and make a call. I run a low power laser beam down through some tables to illustrate VHF signal blocking and reflections. Finally, I make an autopatch call.

Radio Wave Propagation

I use the laser beam to bounce signals off of a mirror on the ceiling to demonstrate the ionosphere. I bounce Smurf balls off the ceiling to further demo skip. I use a prism to illustrate the refraction of different wavelengths. I tune into WWV for the solar activity report and let students write down the figures they hear.

Amateur Radio Practice

I pass around equipment destroyed by lightning. I illustrate ground foil and braid by letting students actually feel the materials. We examine a ground rod. We spark a charged capacitor to illustrate the importance of staying away from capacitors in power supplies. We pass around a nylon safety belt, and an old leather safety belt, and caution students to stay away from brittle leather belts. I pull sparks off of an HF antenna to illustrate the hazards of RF burns. I transmit and receive interference on my PA system, illustrating overload. A simple oscilloscope can illustrate harmonics.

Electrical Principles

I short-circuit a #18 jumper lead to illustrate the necessity of fuses, and light a small, 12 volt light bulb to illustrate the tough topic of frequency, wavelengths, and bands. I unroll a 30-foot, cut-up chart from the Government Printing Office illustrating the electromagnetic spectrum. I use fluorescent yarn which attaches the wall chart to various pieces of ham radio and home electronic equipment on the demonstration table. Finally, I sweep the audio spectrum with my code oscillator to allow students to hear audio frequencies.

Components, Signals, and Circuits

I pass around resistors, capacitors, and demonstrate the one-way continuity of diodes. I have students identify various switches, transistors, and tubes which I also pass around. The whole idea here is to ensure that students actually touch and feel of every single component we talk about in class.

I bring in stripped down radios and have students identify different sections within the radio. They identify the transmitter, receiver, TR switching, IF, filters, and so on.

Students hold a fluorescent light tube near a 100 watt energized mobile antenna. They see how quickly RF travels through the air. They watch the tubes flicker as we modulate SSB, and stay solid during double sideband with carrier. They watch it flash on and off with CW, and see it remain solid with HF FSK. We also tune into signals with key clicks, hum, and instability problems.

Antennas and Feedlines

We bring in dipoles, yagis, quads, and loops. We demonstrate an antenna tuner by hooking up to a trash can sitting on a chair outside, and running it against a sewer pipe ground. We further demonstrate the tuner's capability by loading into a Schwinn bicycle, a crutch, and even a juicy pickle, showing that even the latter will radiate a 2 meter signal.

Next, we put the pickle onto closely-spaced pins hooked up to 110 VAC through a code keyer. Depress the keyer, and the pickle instantly lights up yellow and orange, and fizzles and smokes, demonstrating what an old spark-gap transmitter may have sounded like, and maybe even smelled like.

Finally, we illustrate coaxial cable, parallel conductor feedlines, and twinlead, and talk about their advantages and disadvantages by actually lighting up light bulbs at the opposite end of the circuit.

For every hour of classroom instruction, I schedule at least one live demonstration. Both the young and old appreciate any crazy demo, and the more bizarre you get (like roasting a pickle on 110 volts), the better they will remember the particular relationship you were illustrating.

Always observe safety precautions when doing any type of demo that uses any amount of voltage or RF. Always ask if there is someone in the ground that has a pacemaker, and caution them to stay away from any transmitting mobile antenna. Have students wear protective eye gear when snapping off a charged capacitor or energizing something as simple as an automobile 12 volt light bulb.

Always have plenty of props at every class session. Even overhead transparencies and color slides can be effective, coupled with "the real thing" to further illustrate the transparencies. Incidentally, the ARRL has a terrific collection of color slides in their educational library, and you should contact Rosalie White at the ARRL to become a registered instructor to qualify for a loan of these excellent slides describing circuits, emissions, antenna, and other electrical principles.

Classic Ham Class Demos

Do you have a classic ham class demo that students talk about for days and weeks after class is over? If so, write us here at *73 Magazine*, and we'll share your show-and-tells with fellow instructors.

Finally, have as much fun as we do in teaching ham radio to new students. Laugh along with the kids when a demo goes up in smoke, or doesn't work at all. The class will have fun just helping you try to get it off the ground.

Giving your students more than just talk, talk, talk will make your upcoming ham class an outstanding success. Be sure to tune us in on 28.303 on Tuesdays at 17:30 hours Zulu. We hope to hear your class on the air soon.

Photo A. Gordon West WB6NOA assists Kenny, a student, during the CQ All Schools Net from I.S. 72.

Photo B. Left to right: Ed KA2TXL, Carole and Gordon, during Gordon's visit to Carole's class.

Number 13 on your Feedback card

ASK KABOOM

The Tech Answer Man

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Receivers: What Makes Them Tick

In the very early days of radio, all participants were hams in the truest sense. They were experimenting to develop a new and very exciting technology which promised to make worldwide communications a reality. And humans love nothing more than to yack with each other (except perhaps to kill each other, but that's a different story!).

Even in those first experiments, it was clear that it was easier to generate a radio signal than it was to detect onel The signal's existence had already been predicted in Maxwell's and others' theories, and Hertz had shown the invisible waves to be real by wirelessly generating sparks in resonant gaps separated by the distance of a room. But how to do anything useful with them? That was a much greater challenge.

It soon became obvious that the signals got very weak very fast as one moved the detecting apparatus away from the transmitter. You could generate plenty of power with a spark transmitter and be unable to hear it a block away! Clearly, the key to radio lay in the receiver, and it was this facet which subsequently underwent the most evolution. In this multipart series, we'll look at the development of radio receivers and at what makes a receiver good, bad or ugly. Let's start with a little history:

Being Detected

Radio reception consists of two processes: First you must detect the presence of the signal, and then you must decode the intelligence impressed upon it. In the earliest modulation mode, Morse code, both elements were performed by the same component: the detector. (Notice I don't say "CW" here, because that term specifically refers to the generation of code by a continuous wave transmitter, and the early spark sets did not generate continuous carriers. In fact, they produced "Damped Wave," and it was not until radio frequency alternators were invented that CW was heard in the ether.)

The construction of the detector varied from the coherer, which basically was some metal filings in a tube, to the semiconductor diode. (Yup, semiconductors actually predate tubesl When the first chunks of galena crystal were employed as radio detectors, the Audion amplifying tube was not yet a gleam in DeForrest's eye.) The diode detector was vastly superior in sensitivity to the coherer, and the latter was quickly relegated to the attic, and so to history.

In conjunction with a "good" antenna, typically some wire strung in a tree, a crystal detector made a pretty sensitive receiver by the standards of the day. You could make your sparks on an automotive coil and hear them perhaps a mile away. Heck, that was farther than you could yell, so it began to look like a useful thing. But pretty soon a new problem arose: there were lots of sparks on the air, and they were beginning to interfere with each other. That was caused by two things.

First, the nature of spark transmissions was wideband. Plenty of energy was being distributed all over the spectrum. In fact, although it was not recognized at the time, spark's inefficient, wideband nature was a big part of the reason it was so hard to hear at great distances; not much of the energy produced was anywhere near your receiver's frequency.

Getting Selective

The second reason was that receivers had very little ability to separate stations by frequency. That essential characteristic, called selectivity, turned out to be the most difficult to achieve. Early crystal sets, with their single tuned circuits at the antenna connection, gave way to "tuned RF" (TRF) designs when the amplifying tube came along. The tube alone had dramatically increased sensitivity, but that only made the selectivity problem more pressing—now you could hear even more signals, and thus more interference! The TRF sets had several stages of amplification, each with its own knob for tuning it to frequency. It wasn't a bad system, but it required tuning three or more knobs every time you wanted to change the station; it was hardly what we'd want to call "user friendly." And it still wasn't great.

Around and Around

Even the TRF had its sensitivity limits. By the time of its development, broadcasting of music and voice had begun, and people were hungry for something to listen to. Believe it or not, DXing was a very popular pursuit in those days. Most localities had no stations, so people wanted the most "powerful" (sensitive) receiving setups they could get, in order to hear distant stations. Enter Edwin Armstrong.

This very important radio pioneer reasoned that, if the signal could be used to reinforce itself right in the radio, it would make the receiver far more sensitive than the TRF. He developed a circuit called the "superregenerative." In this design, the output of the first tuned RF amp was fed in phase, via a two-coil transformer arrangement, back to the amp's input. Sounds like an oscillator, doesn't it? Well, if you fed back enough signal, it was! But if you cut the amount of regenerated signal back to the point just below oscillation, you had one *heck* of a sensitive receiverl The improvement over the TRF was startling. Signals which were completely inaudible became painfully loud.

The superregen was widely accepted, but the technique had big drawbacks. Some of that regenerated signal went back out the antenna, so every receiver was also a transmitter! And a wideband transmitter at that. The amount of interference superregens generated was tremendous. Also, that phenomenal increase in sensitivity was not accompanied by a similar increase in selectivity, so once again you had a very sensitive radio which picked up lots of garbage.

Finally, the regenerative process caused a loud "whoosh" noise when signal levels were low, not unlike the sound of a modern FM receiver with its squelch open on a vacant channel. It was enough to give you quite a headache. And to top it all off, you had to play with the touchy regeneration control to get the whole thing to work well. Despite these serious shortcomings, the superregen was an important step in receiver evolution. Today, it is largely forgotten except for its use in some very low-priced kiddie walkie talkies and toys. Even in those applications, it is becoming obsolete.

Testing Your Reflexes

As the amplifying tube began to be applied to the audio stages as well as the RF "front end" stage, loudspeaker operation became practical. This had the obvious advantage that the whole family could listen at the same time. The only disadvantage was that it made the radio much more expensive, and somewhat more difficult to build if you were inclined to roll your own, which many people were. Remember, components, and especially tubes, were not cheap in those days. Circuit designers strived to create as much radio from as few parts as possible. One clever arrangement was the reflex receiver.

In this design, the RF amp tube was made to do two jobs at once. Through the use of a few resistors and caps, it was frequency multiplexed (although the term would have been alien to those who conceived the idea). The RF was fed through it and then detected. The detected audio was then fed *back* through the same tube via a low pass filter. Because of the wide separation in frequency of the RF and audio, and the filtering, the two signals didn't interfere with each other. The result was a receiver which could drive a speaker, yet had very few expensive parts. It was cheap, so it was popular.

Unfortunately, it was functionally just a TRF, so it wasn't the greatest performer. It still had lousy selectivity, but now the whole house could enjoy the interference! Occasionally, I see transistor-based reflex receiver projects in hobby magazines. They sure do a lot with very few parts.

Edwin Again

Later in his career, after radio evolution had had time to progress and the problems had been well defined, Edwin Armstrong had the opportunity to assess them point by point and formulate a plan to overcome them. The result was one of his two masterpieces, the superheterodyne receiver. (The other was FM.) The superhet receiver is used in virtually all modern radio and television systems. Though there are many variations on it, the basic scheme remains the same, whether the set is a "walkperson" stereo or a satellite receiver. In the remainder of this series, we'll examine the different points of the superhet in some detail and explore the tradeoffs required in their designs. But for now, let's take a look at the structure of the design and its reason for being.

The Antenna Bone's Connected to The...

Like all receivers, the superhet starts with a tuned circuit at the antenna. Actually, in some modern, frequency-synthesized designs, that isn't true anymore. But most radios do have some kind of LC tank circuit at their inputs. In manually tuned sets, it is likely to be a high-Q resonant circuit which you tune to the frequency you are trying to receive. In electronically tuned rigs, it's probably a low-Q bandpass filter which permits the entire band to pass while rejecting other bands.

Following the tuned circuit may or may not be an RF amp. The advantage of an amp is obvious: more sensitivity. The disadvantage is not so obvious: less dynamic range. By that I mean the biggest signal the radio can handle before it overloads. An overloading front end causes far more trouble than simple audio distortion; the amp becomes a mixer and lots of unwanted signals and garbage wind up getting heard. Most HF ham rigs have RF amps and front panel switches to disable them when the signals are strong.

Depending on whether there is a high-Q tuned circuit at the input, the output of the first stage can consist of one of two things: Either you have a lot of the signal you want and little else, or you have a broad range of signals from the entire band. It really doesn't matter, because most of the selectivity is achieved later on down the signal path.

Mixing It Up

Back when Armstrong employed it, the concept of a mixer must have been novel. A mixer has an important characteristic: It must be nonlinear. If you pass two signals together through a linear stage, their waveforms will add and subtract algebraically, resulting in one composite signal at the output. But the two signals will not actually modulate, or interfere with, each other, and they will still be separable. That is *not* mixing.

If, however, the stage is nonlinear, one signal will modulate the other, causing true mixing. The easiest way to visualize it is the way it happens in an audio amp. If you have a high note and a low note, they can both pass through the amplifier without bothering each other. But let's say you increase the low note's volume until it makes the amplifier clip. Now, the high note gets clipped off, too, because at the moment of clipping *both* signals get cut off. Thus, the low note has interfered with the high one, causing true mixing. It sounds terrible in a stereo, but it's exactly what we want in an RF mixer, because it creates byproducts, and those are what we are after.

We'll continue this radio anatomy lesson next month. Till then, 73 de KB1UM.

Five-component wideband amplifier

Continued from page 12

tors at each end of the board, I installed the standoff insulators. I then soldered the chip capacitors in place with great care—they are small.

Next, I mounted the MAR-8. First I bent pins 2 and 4 down so they touched the copper-clad board (ground), then I soldered them to the board. Pins 1 and 3 were bent straight out to span between the standoff insulators which support the input and output capacitors. Then they were soldered in place.

After this, I slipped the ferrite (or powdered iron) bead over the resistor lead nearest to pin 3 of the MAR-8. I soldered this lead to the standoff insulator connected to pin 3 of the MAR-8. The other end of this resistor was connected to another standoff insulator and became the attachment point for the +12 volt supply. Incidentally, the size of the resistor is chosen to provide approximately 36 mA to the MAR-8. The data sheets recommend 111 ohms, but I used 120 ohms because that is what I had on hand. The data sheets also recommend a 1 µF capacitor from the +12 volt point to ground if erratic behavior is experienced. My amplifier did not need this capacitor.

Figure 1 shows the schematic for the amplifier. Figure 2 gives a pictorial representation of how the amplifier was assembled.

Photo A is a close-up picture of the device. The length of the little enclosure is about 1-1/2" inside of the box. It is about 1/2" wide and about 5/8" deep. In this view the sides of the box have been removed to show the components. MAR-8 can be seen in the center.

After I tested the amplifier, I cut three more pieces of copper-clad board and enclosed the device by soldering the three pieces together to form a box. I have used the amplifier for about six months now with good results. ■

Parts List

Qty.	Device
1	MAR-8
2	100 pF chip capacitors
1	120 ohm resistor
1	ferrite bead
2	chassis mount female BNC connectors
5	insulated standoffs
Misc:	Box (made out of PC board material).

Parts Sources

MAR-8: Mini-Circuits, Box 350166, Brooklyn NY 11235-0003; phone (718) 332-4661.

100 pF chip capacitors & resistor: Mini Circuits, or Digi-Key, 701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN; (800) 344-4539.

RF Bead: Amidon Associates, P.O. Box 956, Torrance CA 90508; phone (213) 763-5770.

BNC connectors: Radio Shack stores.

Number 14 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check SPECIAL EVENTS (Area 11) on our BBS (603-525-4438) for listings that were too late to get into publication.

FEB 1

ST. CATHARINES, ONT., CANADA The Niagara Peninsula ARC Inc. will hold its 14th Annual Big Event Hamfest/Dinner-dance, at the C.A.W. Hall, 124 Bunting Rd. Admission is $4. Tables $12 commercial; $5 non-commercial. Talk-in on 147.24/.84. Dinner-dance tickets are available only in advance. Contact ***N.P.A.R.C. Inc., PO Box 692, St. Catharines, Ontario L2R 6Y3, Canada. (416) 934-3231*** or ***VE3KLM @ VE3SNP.***

KNOXVILLE, TN The Shriners of the Kerbela ARC, Kerbela Shrine Temple, will sponsor the SEVIERVILLE HAMFEST at their Temple in Knoxville from 8 AM–4 PM. Tables $5 plus a $2 admission ticket per person. Tailgating $3 plus $2 admission ticket. Dealer set-up at 4 PM–9 PM Jan. 31, and 5 AM–8 AM Feb. 1. No crafts allowed. Talk-in on 146.34/.94. For table info contact ***Paul Baird KY4A, 1500 Coulter Shoals Cir., Lenoir City, TN 37771, (615) 986-9562.*** FCC Exams by Western Carolina ARS/VEC, Inc. at 9:30 AM, no walk-ins. Mail completed 610 along with your check for $5.25 made payable to ***WCARS/VEC, 5833 Clinton Hwy., Suite 203, Knoxville TN 37912-2545. (615) 688-7771.*** Registration deadline is Jan. 30, 1992.

FEB 8

BLAINE (MINNEAPOLIS), MN The 11th Annual Midwinter Madness Hobby Electronics Show, sponsored by the Robbinsdale ARC, will take place from 8 AM–2:30 PM at the National Sports Center, 1700 105th Ave. NE. Free parking. Indoor Flea Market tables. 76 Commercial booths. Advance tickets $4; $6 at the show. VE Exams on Feb. 7 at 6 PM. Talk-in on 147.66/.06. Contact ***Midwinter Madness Hobby Electronics Show, P.O. Box 22613, Robbinsdale MN 55422. (612) 537-1722.***

FEB 9

MANSFIELD, OH The Mansfield Mid•Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds beginning at 7 AM. Indoor Flea Market. Advance tickets $4. $5 at the door. Tables $9 in advance, $12 at the door, if available. Talk-in, call W8WE on 146.34/.94. Reservation deadline Feb 1, 1992. Send SASE and payment to ***Dean Wrasse KB8MG, 1094 Beal Rd., Mansfield OH 44905;*** or phone ***(419) 589-2415*** after 4 PM EST.

MELVILLE, NY The Long Island Mobile ARC will hold a Hamfest from 9 AM–4 PM at Electrician's Hall, 41 Pinelawn Rd. VHF tune-up clinic. Admission $5 at the gate; exhibitors $20 in advance. Talk-in on 146.25/.85. Contact ***Neil Hartman WE2V, (516) 462-5549,*** or ***Mark Nadel NK2T, (516) 796-2366.***

FEB 14-15

SARASOTA, FL The 13th Annual Sarasota Hamfest/Computer Show, sponsored by Sarasota Hamfest, Inc., will be held at Robarts Sports Arena, 3000 Ringling Blvd. from 1 PM–8 PM Fri.; 9 AM–3 PM Sat. VE Exams at 9:30 AM Sat. Free parking; RV parking $15 per night (pre-registered). Admission tickets $5 in advance, $7 at the door; children under 12 free with an adult. Tables $15 each; booths $20 per table. For more info contact ***Sarasota Hamfest, Inc., c/o Gene Marino W1IDH, 4858 Tivoli Ct., Sarasota FL 34235,*** or call ***(813) 355-0675 from 9 AM–9 PM.*** Informal banquet 7 PM Sat. at Shrine Temple; $15/single, $25/couple.

FEB 16

GOLDEN, CO The Aurora Repeater Assn. will hold its 10th Annual Swapfest at the Jefferson County Fairgrounds, 15200 W. 6th Ave., from 8:30 AM–2 PM. Contact ***Judi WD0HNP, (303) 450-6910,*** or ***Jan KA7TYU, (303) 680-8857;*** or write ***Aurora Repeater Assn., P.O. Box 39666, Denver CO 80239.***

FEB 22-23

CINCINNATI, OH The Ohio State ARRL Convention 1992 will be held at the Cincinnati Gardens Exhibition Center, Langdon Farm Rd. and 2250 Seymour Ave., (State Route 561) 8 AM–5 PM both days. Flea Market admission $6 in advance, $8 at the door. Free parking. Flea Market table charge is $15 per table, prepaid prior to Feb. 16. Late reservations are $17.50 per table. Make checks payable to ***ARRL Ohio State convention 1992*** and mail with application to ***Stan Cohen WD8QOQ, 2301 Royal Oak Ct., Cincinnati OH 45237. (513) 531-1011.*** For info contact ***Joe Halpin W8JDU, 11615 Geneva Rd., Forest Park OH 45240; (513) 851-1056 nites.***

FEB 23

LIVONIA, MI The Livonia ARC will hold its 22nd Annual Swap'n Shop from 8 AM–4 PM at Dearborn Civic Center, Dearborn MI. VEC Exams. Talk-in on 144.75/145.35. For info, send 4 x 9 SASE to ***Neil Coffin WA8GWL, Livonia ARC, P.O. Box 2111, Livonia MI 48151. (313) 427-3905.***

MILFORD, CT All Class Exams by the Coastline Amateur ARA, will be held at the Fowler Bldg., 145 Bridgeport Ave., at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125,*** or ***Dick WA1YOE, (203) 874-1014.***

ROCK ISLAND, IL The 21st Annual Davenport (Iowa) ARC Hamfest will be at the QCCA Expo Center in Rock Island IL beginning at 8 AM. Wheelchair accessible. Flea Market, Commercial exhibits, VE Exams. Talk-in on the W0BXR 146.28/.88 repeater. Tickets $3 in advance, $4 at the door. Tables are $8 each paid in advance by Feb. 15; $10 after the 15th. Commercial booths and AC hook-ups are extra. Hamfest contact is ***Dave Johannsen WB0FBP, 2131 Myrtle St., Davenport IA 52804.*** For ARRL/VEC Exam info, contact ***Al Broendel N9OK, 2712 38th St., Rock Island IL 61201.***

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC will hold its 38th Annual Hamfest at the ST. V. Center, 3479 State Rd., from 7 AM–3 PM. Wheelchair accessible. Tickets $3 in advance, $4 at the door. Tables $5 (sellers may bring their own tables). SASE for ticket orders and table reservations to ***Bill Sovinsky K8JSL, 2305 24th St., Cuyahoga Falls OH 44223. (218) 923-3830.***

NEW STRAWN, KS The Neosho Valley ARC will sponsor an Electronics Hobbyist Auction at the Strawn school bldg. beginning at 10 AM. No entry fee will be charged, but a 10 percent consignment fee will be charged on all items sold. Set-up at 8 AM. Talk-in on 146.52 MHz. Contact ***Bob, (316) 364-5446,*** or write to ***N.V.A.R.C., P.O. Box 931, Burlington KS 66839.***

FEB 29

BISMARCK, ND A Hamfest sponsored by Central Dakota ARC, will be held at the Comfort Inn, 1030 Interstate Ave., from 8 AM–3 PM. Advance tickets $2, $3 at the door. Tables $4. Contact ***COARC, P.O. Box 7162, Bismarck ND 58507. Dee KB0CGK, (701) 224-9139.***

BROOKSVILLE, FL The Hernando County ARA will hold its 10th Annual Hamfest at the Hernando County Fairgrounds; located about two miles south of Brooksville on U.S. Hwy. 41. Doors open at 8 AM and close shortly after 3 PM. Free parking. Overnight parking will be permitted, but there are no facilities. Indoor swap areas. Advance tickets $4. $5 at the door. Send SASE and check to ***Hamfest Chairman, 205 N. Alpine Circle, Brooksville FL 34601.*** Ticket requests received after Feb. 20 will be held at the gate. Tables $10; Tailgate space $5. Everyone, including dealers, must purchase a ticket. Talk-in on 146.115/.715 (club frequency). For info call ***(904) 796-4840 after 7 PM.***

ORANGE, TX The Orange ARC will sponsor their 7th Annual Hamfest-Flea Market at the V.F.W. Hall on Hwy. 87, one mile north of IH 10, in Orange TX, from 8 AM–4 PM. Free admission. Paved parking. Set-up at 7 AM. Tables $5 for individuals, $15 for dealers—no limit. Pre-registrations must be postmarked by Feb. 9. No refunds on unclaimed tables. VE Exams at 9 AM; send 610 Form, with a copy of your current license and any C.S.C.E., with a check for $5.25, to ***Orange ARC, P.O. Box 232, Orange TX 77630.*** Bring original documents. Walk-ins accepted, but preference will be given to pre-registrations. For info call ***Sherwood Buckalew KA5VOT, (409) 883-6111*** or ***Dan Killough WB4GYS, (409) 769-8436.***

MAR 1

YORK, PA The 5th Annual York Springfest (Ham/Computer) will be held indoors at the Dover Fireball beginning at 8 AM. Blacktop parking. Tables $4; tailgating $2 per space. Admission $4. Unlicensed spouse and children under 12 free. VE Exams. Talk-in on 146.37/.97. For info and registration call ***(301) 239-3878,*** or write ***York Springfest, P.O. Box 316, New Freedom PA 17349-0316.***

YONKERS, NY The Westchester Emergency Communications Assn. will sponsor their 8th Annual ARRL sanctioned Hamfest/Computer Show from 9 AM–2 PM at Yonkers Raceway, Intersection of I-87, Central and Yonkers Ave. Admission $5; children under 14 free with adult. Tailgating. Handicap entrance and parking. Walk-in FCC Exams. Preregistration required of all vendors (including tailgating). Contact ***Sarah Wilson N2EYX, 3478 Russell Place, Yorktown Heights NY 10598. (914) 962-7279.*** Talk-in on 147.060.

MAR 7

CAVE CITY, KY The 16th Annual Glasgow Swapfest will be held by the Mammoth Cave ARC, at the Cave City Convention Center, beginning at 8 AM Central time. Admission $4 per person. Tables $5 each. VE Exams, walk-ins welcome. Be sure to bring your original license and a copy if you are upgrading. Talk-in on 146.34/.94. For info and reservations, write to ***N4HCO, 1379 Whites Chapel Rd., Glasgow KY 42141.***

ABSECON, NJ The Shore Points ARC will sponsor its 10th annual hamfest "Springfest '92", at Holy Spirit High School on Route 9, ½ mile south of Route 30. Doors open to the public at 9 AM. Set-up at 7 AM. Outdoor tailgating space will be available on the day of the hamfest, weather permitting. Limited AC is available indoors. Sellers: $5 per 8' table; buyers: $4. (XYL's and children free.) Free parking. Talk-in on 146.385/.985. For info write to ***SPARC, P.O. Box 142, Absecon NJ 08201.***

MAR 8

INDIANAPOLIS, IN The Morgan County Repeater Assn. will sponsor the INDIANA HAMFEST at the Indiana State Fairgrounds Pavilion Bldg., beginning at 8 AM. Admission $7 at the door. 8' Flea Market tables (including space) $12 each. No space will be sold without a table. Set-up Sat. Mar. 7 from 3 PM–9 PM. Security provided overnight. Set-up Sun. Mar. 8 from 6 AM–8 AM. All vehicles must be out of the building by 7:45 AM. Free parking. Talk-in on 145.25. For info/reservations, send SASE before Feb. 22 to ***Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47403. (812) 339-4446.***

SPECIAL EVENT STATIONS

FEB 1-2

VERMONT QSO PARTY The Central Vermont ARC will host the Vermont QSO Party from Feb. 1 at 0000Z–2400Z Feb. 2. Stations may be worked on CW, Phone, RTTY, Packet, or AMTOR, up to 5 times on each band. Exchange signal report and QTH (county for VT stations; state/province/county for others). Frequencies: Phone–lower 25 kHz of the 80-15 General bands and 28.3–28.5 MHz; CW–40 kHz up from bottom edge of 80-15 meter band and in Novice bands; other modes in the usual area of all bands. Count 1 point for phone QSO, 2 points for other mode QSOs. Multiply by number of counties or states/provinces/countries. Work W1BD for an extra multiplier. Log sheets and scoring sheets available for SASE from QSO Party Manager ***Bob DeForge K1HKI, RR #1 Box 271, Brookfield VT 05036.*** Entries must be mailed by March 1st. For results send an SASE.

CADILLAC, MI The Wexaukee ARA will operate Station WD8KUS from the North American Snowmobile Festival from Feb. 1 at 1400 UTC-0400 UTC Feb. 2. Frequencies: 7.245 MHz ± QRM, 28.345 MHz ± QRM, and 146.98 MHz (−600) repeater. For a certificate, send a QSL with a 9 x 12 SASE to ***Wexaukee ARA, P.O. Box 163, Cadillac MI 49601.***

FEB 1-29

VOICE OF AMERICA QSO PARTY The Voice of America will celebrate its 50th Anniversary by holding a QSO contest from Feb. 1 at 0000 UTC–2359 UTC Feb. 29, to help promote worldwide awareness of the many amateur radio stations that are affiliated with VOA. The object is to log as many VOA related stations around the world as possible within the given time frame. All VOA amateur stations will add the suffix /VOA, "slash VOA" when they sign their call. Stations outside the U.S. will announce that they are "VOA 50th Anniversary" stations. Frequencies ±QRM; Phone–3920, 7260, 14316, 21416 and 28416 kHz. All other modes–3550, 3725, 7050, 7125, 14050, 21050, 21150, 28050 and 28150 kHz. SWL entries are encouraged. Logs must be received at VOA Headquarters no later than Apr. 30, 1992. Contact ***Voice of America Amateur Radio Club K3EKA, Attn: Contest Committee, 330 Independence Ave., SW, VOA Mail Room-Code 73, Washington DC 20547.***

FEB 7-16

VERNON, BC, CANADA The North Okanagan RAC will operate Station VE7NOR during the 32nd Annual Vernon Winter Carnival. Frequencies: 28.575, 14.275, 7.175 and 3.775. The "Winter Carnival Award Certificate" is free with a QSL card or QSO log info, but we request that amateurs please send $1 or 2 IRCs to cover postage to ***Winter Carnival Award-VE7NOR, Box 1706, Vernon BC, Canada V1T 8C3.***

FEB 15-16

PHOENIX, AZ The Motorola ARC of Arizona will operate KG7RS on Feb. 15, 1500Z–0100Z Feb. 16, to commemorate Arizona's 80th Birthday. Operation will be in the lower portions of the 40, 20 and 15 meter General phone subbands and the 10 meter Novice subband; CW in the General and Novice CW subbands. For unfolded certificate, send QSL and 9 x 12 SASE to ***KG7RS, 2802 N. 34th St., Phoenix AZ 85008.***

FEB 21-23

MARQUETTE, MI The Hiawatha ARA will operate a Special Event Station honoring the UP 200 Sled Dog Championship. The station will run from Feb. 21 at 7 PM–1 PM Feb. 23. Frequencies: 28300–28500, 21300–21450 and 14225–14350. For a certificate, send QSL and SASE to ***N8GBA, 21 Smith Lane, Marquette MI 49855.***

FEB 27-MAR 1

DELANO, CA The Kern County Central Valley ARC will operate W6LIE from the transmitter site of "Voice of America" short wave station. Frequencies: SSB–3.855, 7.235, 14.245, 21.335, 28.335 and 28.535; CW–3.535, 7.035, 14.035, 21.035, 28.035; Digital–3.065, 7.065, 14.065, 21.065, 28.145. For special QSL card send SASE to ***W6LIE Special Event, P.O. Box 743, Bakersfield CA 93302, U.S.A.***

MAR 1-2

WISCONSIN QSO PARTY The West Allis RAC will host the Wisconsin QSO Party from Mar. 1 at 1800Z–0100Z Mar. 2. Modes CW and Phone. Work all stations once per mode on each band. Frequencies: CW–3550, 3705, 7050, 7125, 14050, 21150; Phone–3890, 7230, 14290, 28400. Entries must be postmarked by Apr. 15 and sent to ***Wisconsin QSO Party, West Allis Radio Amateur Club, P.O. Box 1072, Milwaukee WI 53201.***

Random Output

Continued from page 84

you do to pay the rent?") If that goes nowhere, ask him what he does in his spare time. ("Do you have any hobbies other than ham radio?") Find a common interest, and don't be afraid to talk a little about yourself. ("I've got to keep an eye on the clock. My wife and I have tickets to a Motley Crue Concert.") If you're excited about something, you should be able to interest someone else in it.

Current Events

Talking about recent news stories is a good way to get the conversation rolling. A simple question like, "Did you hear the latest from the Soviet Union?" might open up all kinds of topics from Marxist doctrine to an ol'-timer's WWII stories. With the map of *Europe* changing *on an* almost weekly basis, the upcoming presidential election, and whatever scandal the press has seen fit to sell soap with this week, great conversation starters are always as close as your newspaper.

The Second Time Around

If the first QSO with someone was anything close to a real conversation, you should honestly listen for that callsign again. Second QSOs are usually much more easygoing than the first.

Make reference to something you discussed during your first contact ("So, how was that Motley Crue concert?"), or go off on a new tangent. Answering a CQ with, "Hi, Joe...it's Dave, N1GPH. How ya' doin'?" immediately starts things off on friendly footing.

It Takes Effort

It's not easy to get to know someone over the radio. It takes a real effort to drag some people out of their shells and get them to open up about themselves.

Keep at it. If we all strive to be better conversationalists, it will make us all better communicators.

Number 15 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Space Symposium and More

The 1991 AMSAT Annual Meeting and Space Symposium was held at the Los Angeles Airport Holiday Inn from November 8–10. Over 200 satellite enthusiasts from around the world attended. A thousand miles to the east, the Houston Ham Convention hosted *Mir* cosmonaut Musa Manarov U2MIR/UV3AM, Boris Stepanov UW3AX and several American astronauts. For participants in both locations, it was a great weekend.

The Russians Were Here

Thanks to the efforts of Jim Carmody NN5O, the Texas DX Society, and past AMSAT President Vern "Rip" Riportella WA2LQQ, arrangements were made to bring Musa and Boris to Houston for the yearly convention. Musa has spent more time in space than most cosmonauts and has logged many hours on 2 meters talking and running packet from the Soviet *Mir* space station. He has been involved with the aircraft and space communications business for nine years, and is currently involved with space station simulations at the Baikonur Cosmodrome to help with any situations that may occur onboard *Mir* during day-to-day operations. When not in space or pursuing other activities, he is active on packet and 2 meter voice in Moscow.

During Musa's time in *Mir*, the United Nations requested that he observe and record pollution caused by the oil-well fires in Kuwait. He brought these videos and more to Houston.

Musa came to Houston on the Wednesday before the ham convention. On Thursday evening he had a chance to meet with Payload Specialists Ron Parise WA4SIR and Sam Durrance of STS-35, along with Marti Laine OH2BH, the Project Coordinator of the recent ZA1A DXpedition to Albania, and several NASA hams and Texas DX Society members. Musa, eight astronauts, and Boris (who was delayed in Paris) got a VIP tour of the Johnson Space Flight Center on Friday.

Starting on Saturday, a joint program at the Houston Ham Convention with astronauts Ken Cameron KB5AWP and Steve Nagle N5RAW went very well. Ken and Musa talked about their attempted QSO between STS-37 and *Mir*. While Musa was striving to make radio contact with the astronauts on 2 meters, the shuttle crew was watching through the window as *Mir* passed by. Unfortunately this was the same window that normally was home to the astronauts' VHF antenna. Although STS-37 was heard on *Mir*, and *Mir* was heard by the astronauts, the complete two-way contact was not quite successful. Future attempts will undoubtedly occur when the next Shuttle/*Mir* opportunity comes along. STS-45 this spring might be a good possibility.

The Houston gathering eagerly watched Musa's video tapes of activities on *Mir* and the Kuwait fires. There were also opportunities to get autographs from Musa before his departure for Newington and a visit to the ARRL.

Back in L.A.

The AMSAT activities in Los Angeles began at high noon Friday, November 8th. Two concurrent seminar sessions were held that afternoon. One was the AMSAT and ARRL Education Workshop, chaired by Rosalie White WA1STO of the ARRL. Several topics were covered, all with the common theme of satellites in education.

The parallel program started with the presentation of a paper by Peter Goldman and Brent Helleckson on the efforts of the Deep Space Exploration Society (DSES). Approaching DSES from an amateur point of view, they discussed using 18 meter dish antennas located in Colorado for deep space craft data reception and radio astronomy.

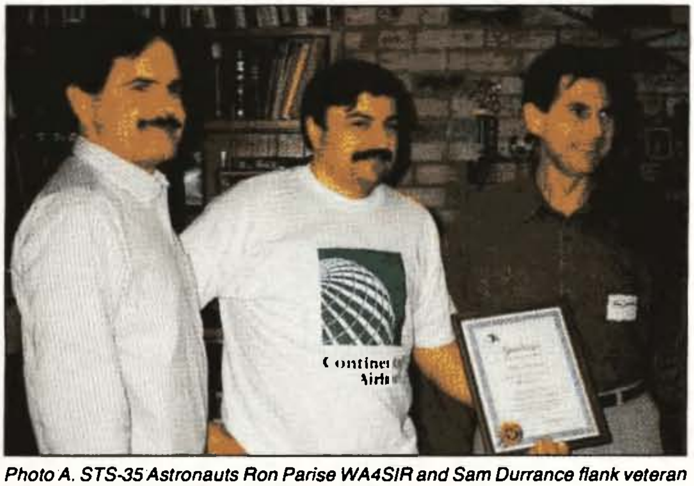


Photo A. STS-35 Astronauts Ron Parise WA4SIR and Sam Durrance flank veteran Mir *Cosmonaut Musa Manarov U2MIR in Houston, Texas.*

Photo B. AMSAT Director and Vice President of Engineering Jan King W3GEY compared features of the proposed Phase-3-D spacecraft with previous hamsats.

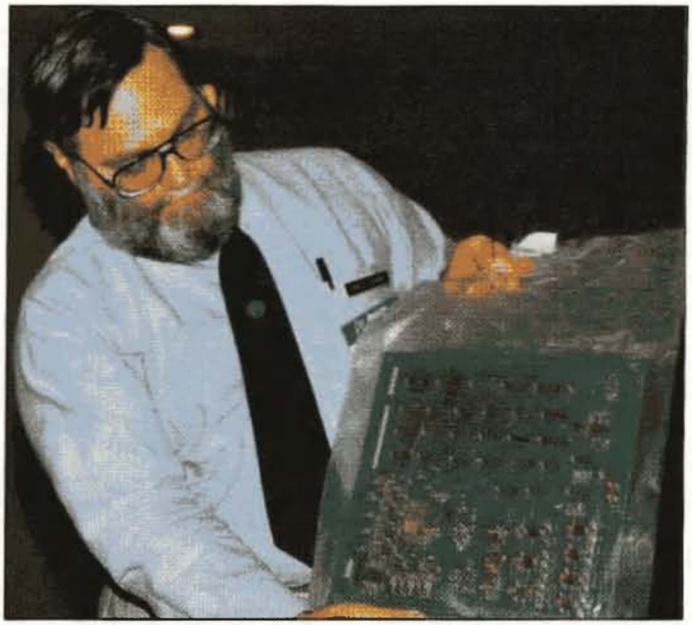


Photo C. AMSAT Director Dr. John Champa K8OCL showed a development board produced by the Detroit OSCAR Users Group for the SEDSAT Project.

Then AMSAT Director Dr. John Champa K8OCL discussed the Solar Sail program of the World Space Foundation. The World Space Foundation would like to see spacecraft developed to travel between the planets, powered by giant sails using the pressure of photons from the sun. For more information on this program, refer to *Project Solar Sail*, edited by Arthur C. Clark.

Dennis Wingo KD4ETA and Cheryl Bankston KD4FPH provided an update on SEDSAT 1, a microsat-class satellite potentially flying as a secondary payload as part of NASA's Small Expendable Deployer System (SEDS) flight demonstration project. SEDSAT 1 would be placed in a circular orbit with a mean altitude of 730 km at 39 degrees inclination. Several amateur radio systems for analog and digital communications would be included with an array of scientific experiments to study orbital mechanics, the dynamics of tethered satellites, and remote sensing.

Joe Kasser W3/G3ZCZ discussed the use of gateways between terrestrial amateur radio operators and satellite-based communication systems in the 21st century. Representatives of Weber State University presented information on recent Weber-OSCAR-18 efforts and told of the proposed Astronaut-Deployable Satellite (ADSAT) program. Dan Schultz N8FGV proposed a radio astronomy experiment for the new Phase-3-D satellite or the solar sail.

In the hotel lounge, videos of the new "Amateur Radio in Space" production (available from the ARRL) were shown, along with John Fail (KL7GRF)'s tapes of the CE0ZZZ (Juan Fernandez Island) and XF4L (Revilla Gigedo Island) satellite DXpeditions.

Saturday morning started with a welcome from AMSAT Executive Director and Chairman of the Board of Directors Doug Loughmiller KO5I. He was followed by Brooks Van Pelt KB2CST with a description of the development of applications for the DSP-12 Terminal Node Controller (TNC).

AMSAT Director Dr. Bob McGwier

Photo D. AMSAT Area Coordinator Doug Howard KG5OA took a turn at the Space Symposium earth station.

N4HY continued with an in-depth description of the myriad difficulties encountered by ground control stations working with DOVE-OSCAR-17 and its digital voice system. Problems controlling DOVE have been compounded by the apparent failure of a capacitor in the satellite's S-band (2.4 GHz) transmitter, making these signals unusable by stations attempting software uploads—even those employing advanced digital signal processing systems. Efforts continue and optimism is high since most of the satellite's subsystems are performing quite well.

AMSAT President Bill Tynan W3XO presented findings on the successes of the Shuttle Amateur Radio Experiments (SAREX) in 1991. With STS-35 and the all-ham crew efforts of STS-37 now history, he provided insight into future efforts with the voice-only proposals for STS-45 and more elaborate configurations later.

AMSAT Director and Vice President of Engineering Jan King W3GEY began the discussions of the Phase-3-D satellite program. This remarkable hamsat will measure 10 feet across, not including the solar panel "wings." A full-scale model was on display at the hotel. The program will be the most ambitious amateur radio activity to date. Organizations from over 12 nations are involved in the funding, planning and building. The cost of the program will be several million dollars. Launch is scheduled for the latter half of this decade on an Ariane 5 rocket from French Guiana.

Jan discussed some of the possible physical and electronic configurations that have been studied by the international group of satellite designers. He also provided details on the potential coverage and expected uplink signal levels needed to access the satellite. Using a matrix of several uplink bands coupled to different downlink frequencies, operation will be possible from HF through the microwaves. The available power levels on the spacecraft will be sufficient to allow mobile stations to make easy two-way contacts when conditions are good. The orbit will be elliptical like OSCARSs 10 and 13, but will be fine-tuned to avoid the difficulties inherent with elliptical orbits (like the coverage pattern of OSCAR 10 and the predicted demise of OSCAR 13 in 1996 due to solar and lunar forces).

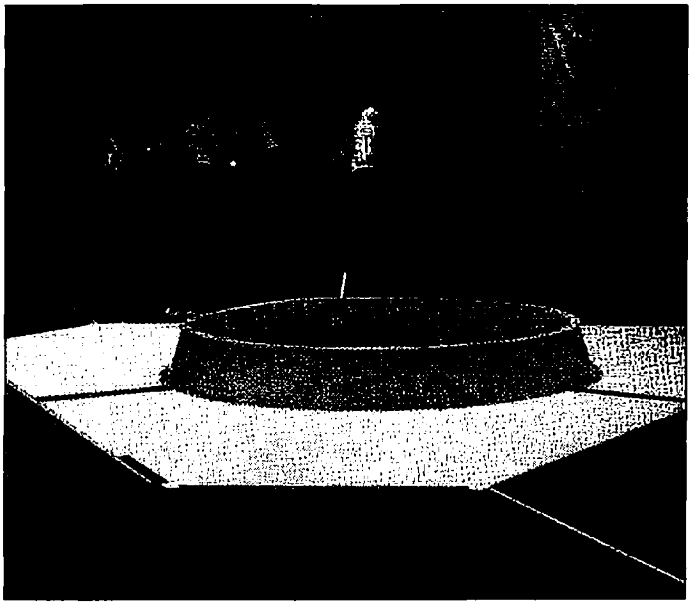


Photo E. The Phase-3-D full-size hamsat model was on display at the space symposium.

Ed Krome KA9LNV described his low-cost Mode-S equipment for OSCAR 13 operation. Mode S uses a 70 cm uplink coupled with a 2.4 GHz downlink. Although this combination may seem difficult to use, Ed's efforts and results have been exceptional. He uses a simple loop yagi connected to a downconverter from Down East Microwave, and a 2 meter multi-mode receiver. This arrangement is cheaper than a Mode-L (23 cm up and 70 cm down) ground station which needs power or high gain antennas on 1269 MHz. Mode S promises to become a primary mode on future hamsats.

John Champa K8OCL gave a talk on motion and color video via Phase-3-D. His proposal is to use Amateur Digital Video (ADV) instead of standard Amateur Television (ATV) on the future satellite. A few years ago this idea was considered beyond the scope of amateur activities. Today it is quite possible due to the advent of new video compression techniques and high-speed modems. John showed tapes depicting the results of different compression methods on moving video scenes and pointed out the potential bandwidth savings encompassed by these systems. Data speeds as low as 19.2 kbps can be utilized for video, although higher speeds like 56–64 kbps provide better results with current technology. Hundreds of hams are active on UoSAT's 14 and 22 at 9600 bps today. It is not difficult to Imagine relatively inexpensive equipment available for higher speeds when Phase-3-D is launched five years from now.

AMSAT Director Dr. Tom Clark W3IWI told of "Chaos, The Eccentricities of Eccentric Orbits." A few years ago, it was noted that OSCAR 13 was coming out of orbit. Since the satellite's perigee, or low point of its elliptical orbit, is far above any atmospheric influence, the situation seemed impossible. Further studies showed that the satellite was headed for reentry due to forces of the sun and moon. Tom's presentation described the reasons for the decline and discussed circumstances that would have given different results. The timing of the launch and the kick motor firing played parts in the current condition. Early calculations predicted the satellite's demise in late 1992, but further studies with better orbital models showed an end to OSCAR 13 in late 1996. Today, OSCAR 13's perigee is holding steady around 600 km. Later in the year it will be on a definite upswing and back to 800 km by January 1994. Sometime in November or December 1996 it should become a shooting star across the sky. By then Phase-3-D should be up or nearing launch.

Harold Price NK6K gave an update on microsat operations. His presentation focused on the heavy use of AMSAT-OSCAR-16 and LUSAT-OSCAR-19, and the need for higher data speeds and more digital satellites. A-O-16 and L-O-19 have been active at 1200 bps since launch but are capable of 4800 bps. Efforts are underway to test the higher-speed capabilities and to develop more spacecraft with 9600 bps like UoSATs 14 and 22.

Martin Davidoff K2UBC, author of *The Satellite Experimenter's Handbook*, provided insight to the proposed AMSAT MARS-A Experiment. While Phase-3-D is shown to be 10 feet across, the space in the center of the satellite, where the adapter cone for other payloads on its flight is located, is vacant. The MARS-A program proposes to build an amateur radio interplanetary probe that will fit in the center of the adapter cone and ultimately send the probe into an orbit around the planet Mars. Martin pointed out that the mission is possible, but there are some serious questions concerning its feasibility. They include designing, constructing and controlling an interplanetary spacecraft. Power for the onboard systems and a viable propulsion system are other key considerations. The program is an exciting one, but the pool of amateur radio satellite builders around the world is limited and the efforts toward Phase-3-D could easily require all their time and energy.

Talks on weather satellite imaging (by Jeff Wallach N5ITU), Volunteers in Technical Assistance (VITA) operations via U-O-22 (by Mark Oppenheim KD6KQ), satellite telemetry considerations (by Joe Kasser W3/G3ZCZ), activities with the Soviet Space Exhibit in Fort Worth, Texas (by Keith Pugh W5IU), and a description of the University of Surrey satellite program (by Martin G7DQE) completed the Saturday symposium agenda. The day finished with the AMSAT Annual Meeting, the President's report to the membership, a gourmet buffet dinner, awards presentations, and the prize drawings.

Sunday morning began with a beginner's satellite primer and forum hosted by AMSAT Vice President of Field Operations Mike Crisler N4IFD. A tour of the Jet Propulsion Lab followed for those who did not wish to attend the Board of Directors' meeting. Most participants took off for home on Sunday while the Board meeting participants went back on Monday. Symposium Committee Chairman Gene Davies AA6NP and his crew did a fantastic job of preparing and running the weekend events. Next year's symposium will be held at the Intelsat headquarters in Washington, DC. Make plans now to attend!

Copies of the *Proceedings of the AMSAT-NA Ninth Space Symposium* are available from AMSAT or the ARRL. The book is 8-1/2" x 11", 260 pages long and softbound. It's well worth the cover price of $12. For details on shipping charges, contact AMSAT at (213) 589-6062.

Number 16 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

I'm very happy to know that Rod Hallen will continue to report about ham activity when he makes his move to Pakistan from Kenya. Hopefully, he can also get a ham license and operate from there even though he has been told not to hold his breath.

Milen Postadshieff LZ2MP has sent us the first of hopefully many bits of news from Bulgaria. I think you will agree with me that his first is a good start.

73 has been receiving quite a bit of mail from hams in the USSR who are listing OSL services. I have a feeling that they will become too numerous for inclusion in this column so I will include them in the 73 International area on the 73 BBS for those who wish to use these services.

I received an interesting phone call from John Young in the Washington, D.C., area. He used to be a ham but let his license lapse. It appears that he is an SWLer now. He was listening to some CW on 8880 kHz and heard three amateur callsigns, two from the USSR and one from Yugoslavia (of course they could be bootleggers). As far as I know, that frequency is outside the international amateur allotment. I guess that there are many hams that get their kicks by operating outside the authorized frequencies. It must be the excitement of getting away with something that is against the rules. But have these people really thought about what will happen to them it they are caught? I have to assume that they have not, or if they have, the risk of getting caught is worth it.

Maybe I'm getting fuddy-duddy in my old age but I value my ham license and the hours of fun that it provides me. I have made many friends via the airwaves, some that I have met and some that I will probably never meet face-to-face. That is one thing in amateur radio that I will never get tired of, the ability to meet new friends around our world.
—Arnie N1BAC

Roundup

Brazil *From Nubio Nunes Revoredo for Ari Carstens:* Amateurs of Rio de Janeiro are planning an amateur radio contest during the 1992 World Conference on Ecology (ECO/92). The conference is sponsored by the United Nations. Further information may be received by contacting Mr. Ari Carstens, Unser Nest PO Box 97.109, Nova Friburgo 28.601, Rio de Janeiro, Brasil, or FAX to PY1RMS/Renate (55)21.709.1104 PY1RMS/Renate, or Mr. Nubio Nunes Revoredo, Rua Carlos Pereira Leal, 238, 26285 Nova Iguacu, RJ, Brasil. *[We will publish the dates in this column when we receive them. The rules will be published on the 73 BBS.—Arnie]*

Japan *From the JARL News:*

7K2 to 7N4 Prefixes

Japanese callsigns usually begin with "J" but, as of April last year, all such signs allocated to the Kanto area (the area around Tokyo) were used up, and as an exception, new callsigns beginning with "7" (7K1 to 7N1) were introduced in the area.

However, as of August this year the allocation of callsigns with the prefix "7N1" is all but full. To cope with this situation, on July 23 the callsign designation standard for identification of amateur radio stations was partially amended, and the new prefixes of "7K" to "7N4" have now been allocated to the Kanto area. (NOTE: The number of amateur radio stations in Japan came to 1,124,018 as of the end of June 1991).

Radio Communications Area Opened

On August 1, a ceremony to mark the opening of the Radio Communications Section took place at the Communications Museum, Tokyo, in the presence of Mr. K. Sekiya JA5FHB, Minister of Posts and Telecommunications, Mr. S. Hara JA1AN, President of JARL, an audience of ministerial officials, and the press. Following a congratulatory speech by the Minister, the tape was cut, and Mr. Suzuki, Chairman of the Kanto Postal Services Bureau Amateur Radio Club, JM1YPK, made a commemorative QSO with JARL's Sugamo station, JA1YAA.

The new Radio Communications Section will be a permanent exhibit, designed especially for young people to learn correct amateur radio communications procedures.

JARL Youth Visits Shanghai

A JARL youth team comprised of 11 members, seven of whom were boys and girls aged between 11 and 13 and possessing ham licenses, traveled to Shanghai from August 8th through the 13th.

Led by chief advisor Mrs. Tenkoko Sonoda, wife of the late Mr. Sonoda, former Minister of Foreign Affairs, the team visited a variety of interesting places, the foremost being stations BY4AA and BY4ALC. The youngsters made friends and exchanged greetings with young Chinese people by means of amateur radio whenever possible. It is hoped that the new spirit of friendship developed there will be a lasting one.

Japan Amateur Radio Development Association

On August 22, a ministerial sanction was accorded and the Japan Amateur Radio Development Association (JARD) was established. The Association is currently making necessary preparations to officially assume responsibility for the technical standard qualification of amateur radio equipment.

The purpose of this association is to contribute to sound development and utilization of radio waves, and to promote amateur radio through technical standard qualification of amateur equipment under the Wireless Telegraphy Act, handling of applications for amateur radio licenses, training of amateur radio operators and cooperation and supervision to maintain orderly use of amateur radio.

The address of the organization Is Kojima Building, 1-24-3, Sugamo, Toshimaku, Tokyo, 170 Japan.

Also from Japan via Tom KA8ZE: I am in the USAF and I have been at Misawa for one-and-a-half years. My call has confused many a DXer!! I was issued this call by the USFJ/AMRS (Far East military command) in Yokota, Japan, to use while I'm on an air base. Thanks and good luck, Tom KA8ZE. *[It appears that this can be true of KA2–KA8 prefixes. Any 2 x 2 callsigns with the prefix KA2–KA8 indicates a U.S. military call in Japan. The card is so nice that I'm including it in the column.—Arnie]*

USSR *From Oleg Y. Latyshev, UA6HPR:* The High Mountain DX Club (HMDXC) has an award program. Some of the awards include: WARO (Worked All Russian Oblasts), 5BWARO (five-band WARO), WHMS (Worked with High-Mountain Station), HMAC (Highest Mountains All Continents), 5BHMAC (five-band HMAC), and HMDXCA (High-Mountain DX-Club Award). A special streamer "North Kavkaz-91" is given for one contact with R6E—high mountain DXpedition of HMDXC. QSL cards for R6E go to UA6HPR, PO Box 999, Stavropol, 355044, USSR.

For more information or to become a member of HMDXC, write to: Oleg Zhukov, PO Box 410, Kaliningrad-10, Moskow obl, 141070, USSR. *[A description of the awards will be placed on the 73 BBS under HMDXC Award Program.—Arnie]*

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

Many thanks to those who commented on my "maiden" contribution in the December issue. It feels odd writing this in November *[to be in the February issue]*, after already having seen the December issue, but I'm sure I'll get used to this "time warp."

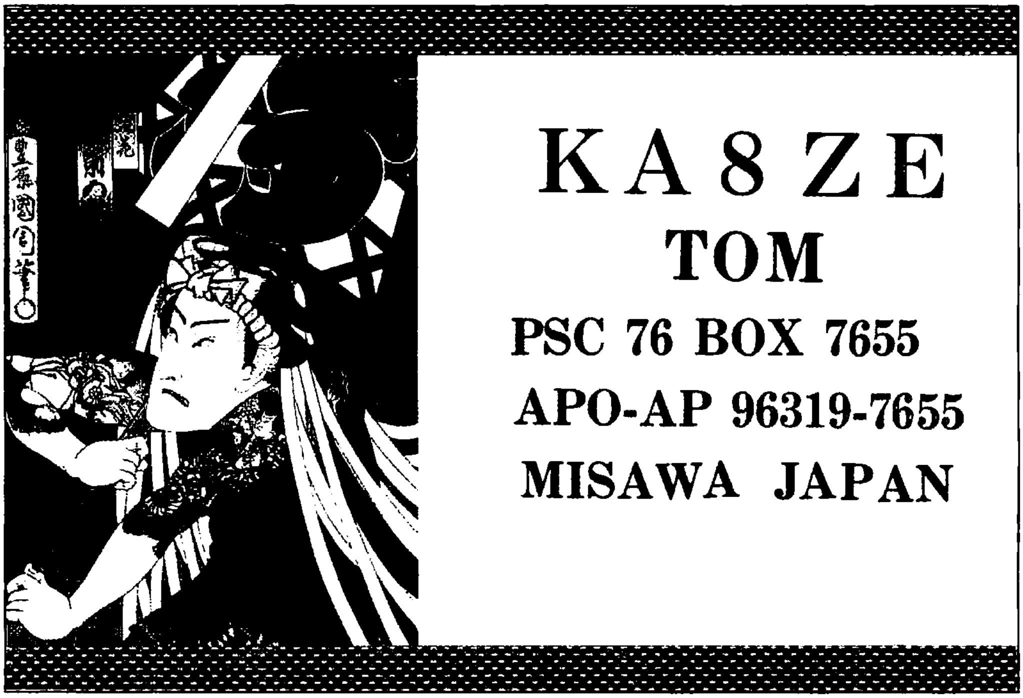


Photo A. QSL card from Tom KA8ZE.

By the time you read this, the "Ross Hull VHF/UHF Contest" will be over, and preparations will have started for the "John Moyle Memorial Field Day Contest" this March. There are only about half a dozen national contests, and interest in them seems to be dropping.

There is a growing amount of interest in the use of spread-spectrum techniques for amateur communications, if the attendance at a recent lecture was any indication. A careful reading of the regulations indicates that frequency hopping and direct-sequence emissions are NOT prohibited modes for Australian amateurs, as no restrictions are placed on modes above 30 MHz, except for the usual conditions (fast-scan ATV above 420 MHz, etc.). Of course, we won't even contemplate getting an official ruling on this. Progress is made by doing it first, then finding out whether or not it was legal.

Finally, Australia looks like it's going to get a new licence class—the Code-Free Novice. When Novices gained 2m FM privileges recently (voice only, not packet), this was a great success, with 2m FM band providing a "common" band for all classes of licences. If WIA proposals are accepted by the Department of Transportation and Communications, this will see Novices permitted operation on 70cm as well as 2m, with packet radio operation, and the 5 wpm CW requirement dropped for Novice VHF/UHF access only. I'll have more news on this in a future column, but it certainly looks like encouraging more people (especially computer afficionados) to join the diminishing ranks of amateur radio.

Cheers for now. Those with access to Internet or packet can contact me as "daveips.OZ.AU" and "VK2KFU @ VK2RWI.NSW.AUS.OC" respectively.

BULGARIA

Milan Postadshieff LZ2MP
PO Box 237
7000 Russe
Bulgaria

Packet: LZ2MP @ HB9AK.CHE.EU
LZ2MP @ DK0MTV.DEU.EU

It will be really a great pleasure for me to send you some ham radio information from Bulgaria from time to time. The mail from the USA to Bulgaria usually takes between two weeks and one month, but from Bulgaria to the USA it takes even two months, regardless of whether the letter was sent by surface mail or by airmail. Any who wish to contact me should probably use the packet BBSs listed. I check them on a daily basis.

Since last July, in addition to 1.8/3.5/7/14/21/28 MHz, two other bands have been opened for the hams in Bulgaria: 18 and 24 MHz. The permission is valid until 31 December 1995 and we are allowed to use the bands as follows: 18068–18100 CW, 18100–18110 RTTY + CW, 18110–18168 SSB + CW, 24890–24920 CW, 24920–24930 RTTY + CW, 24930–24990 SSB + CW.

Most of the hams here are running home-brew transceivers and haven't used these new bands. But about seven years ago the Central Radio Club of Bulgaria imported some Kenwood TS-830s from Japan. The transceivers have been paid for by the government and spread all over the country amongst the most active LZ Radio Clubs. One can recognize the club stations from the three-letter suffix starting with K for Club, for example: LZ2KIM. There are about 50 clubs here operational on the WARC bands so I guess there will be some activity on the new bands.

With the recent changes in this part of the world, from time to time we have foreign hams visiting Bulgaria. For those of them who would like to operate from Bulgaria, the following info might be of some interest and use. Until now there are no reciprocal licensing agreements and therefore no guest licenses. BUT, aliens who hold a valid amateur radio license issued by their government may operate any club or private LZ ham radio station in the presence of the manager or the owner, transmitting the callsign of the station, accompanied by stroke and their own home callsign using one of the following languages: Bulgarian, English, German, French, or Russian. So no government permit is needed, only your license and the consent of the station manager or owner.

Wishing you all the best. 73, Milen.

KENYA

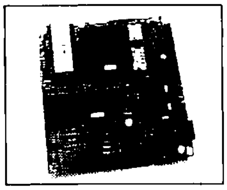
Rod Hallen 5Z4BH
Box 55A
APO New York 09675

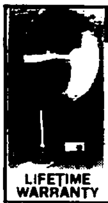
Well, my tour in Kenya is almost over. We leave here 14 December for home leave. After a month in Arizona we will be off to Karachi in January. As I said in my last letter, the license situation in Pakistan is uncertain but I will do what I can to get on the air.

I've made two DXpeditions to the Comoros as D68RH and have given a new country to thousands of DXers. That was my final big blast in Africa. After six years on the continent I'm ready for something new. I have only traveled in the Middle East once so it will almost all be new for me.

That's about all to report from here. The next time you hear from me will be from AP2. My new address will be Rod Hallen, AMCONGEN-RIMC, Unit 62400 Box 124, APO AE 09814-2400.

Say you saw it in 73!



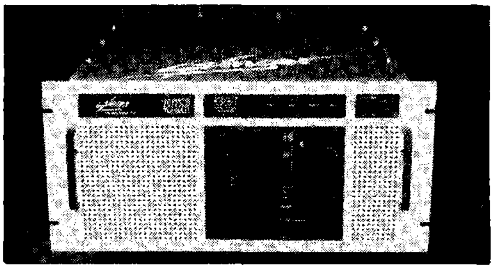


Number 17 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

BESTWAY SYSTEMS



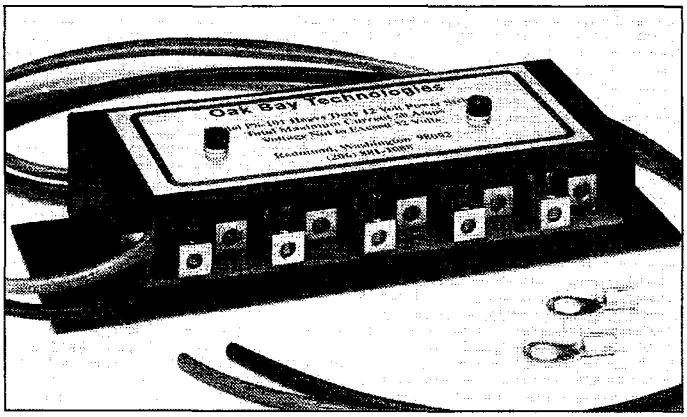
Bestway Systems is now offering the heavy-duty, rack-mounted Stinger chassis. The SCA-1 is an industrially-hardened 19" rack-mount enclosure, capable of housing four full-height internal and four half-height exposed drives. It can accept full- or half-size active/passive main system boards. Constructed of 16-gauge C/R clear zinc plated steel, the chassis allows the user to configure a system to his/her specifications within a state-of-the-art enclosure. The SCA-1 can be used to complement repeaters, telemetry equipment, controllers, power amps and power supplies designed around the standard 19" form-factor. Receivers/transceivers can be controlled using the appropriate DOS software. Additional SCA-1 features include a Mil-Spec 400W 55A power supply which supports simultaneous power-on by all devices, a 100 CFM cooling fan with a TEMPEST grade EMI/RFI filter, emissions-tuned cooling inlets, power on/off key switch and safety-keyed reset button, top cover lock, modular internal bay assemblies, short/overload/thermal and no-load protection, and mounting rails by Accuride.

For the price and more information, contact *Bestway Systems, Inc., 999 Central Park Ave., P.O. Box 54, Yonkers NY 10704; (800) 477-UNIX, (914) 968-9491, FAX: (914) 968-9523.* Or circle Reader Service No. 202.

COMMUNICATIONS SPECIALISTS

Communications Specialists has added another wire harness for direct plug-in of their TS-32P CTCSS encoder-decoder. These plug-in wiring sets can save you considerable time when adding CTCSS encode-decode. The newest wire harness is for the GE Delta radio (part no. 01-1032), and is priced at $2. It can be added to the TS-32P at the time of purchase, or retrofitted to existing TS-32Ps.

Communications Specialists also offers plug-in adaptations of their tone products for many other popular radios. Contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800) 854-0547, (714) 998-3021, FAX: (714) 974-3420.* Or circle Reader Service No. 204.

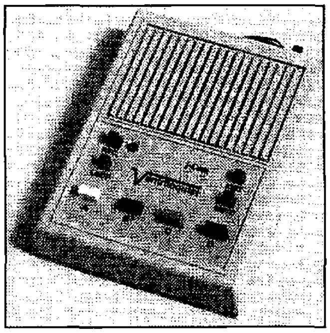


OAK BAY TECHNOLOGIES

The Model PS-101 12-volt power strip from Oak Bay Technologies features five separate outputs, each individually fused, with the ability to handle 50 amps total (not to exceed 32 volts). It provides a complete, easy, safe interface between external equipment and a single-source power supply, putting an end to cumbersome multiple connections. The strip, 10" wide by 3.2" deep by 1.7" high, contains two 30 amp fuses and three 20 amp fuses, along with five feet of eight-gauge copper wire and two ring lugs for connecting to the power supply. The enclosure is manufactured from rugged 20-gauge steel for exceptional sturdiness and vibration resistance.

The Model PS-101 is available through amateur radio dealers for a suggested list price of $79.95. For more information, contact *Oak Bay Technologies, %Evelyn Garrison & Associates, 21704 S.E. 35th St., Issaquah WA 98027; (206) 557-9611, FAX: (206) 557-9612.* Or circle Reader Service No. 201.

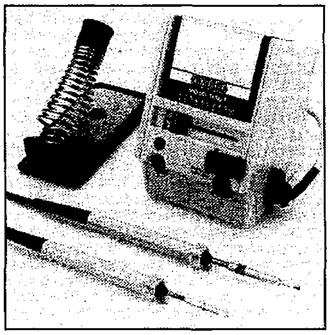
J•COM



The Ventriloquist™ voice keyer and audio memory from j•Com is based on the recently released ISD series of integrated circuits featuring direct storage of analog signals in non-volatile, electrically erasable, programmable memory. Unlike conventional digital voice keyers, Ventriloquist records and reproduces analog signals directly at a rate of 6,400 samples per second, achieving a 2.7 kHz signal bandwidth with less than 2% THD. The use of EEPROM technology means that the memory will retain the signal for up to 10 years without power, unlike RAM-based systems. Unlike EPROM-based systems, Ventriloquist will erase and rerecord directly without the need for sophisticated equipment or manufacturer reprogramming.

Ventriloquist contains a built-in microphone for recording and a speaker for playback. The unit interfaces easily with most modern transceivers. A PTT keying circuit is provided to operate the transmitter automatically when a message is played. It also includes a built-in computer interface which may be connected directly to the printer port of any PC-compatible computer. This interface has been designed to be directly compatible with the ubiquitous CT contest program.

As an assembled and tested PC board, Ventriloquist sells for $124.95; with a high-impact ABS enclosure, $149.95. Prices include U.S. shipping. For more information, contact *j•Com, P.O. Box 194, Ben Lomond CA 95005-0194; (408) 335-9120, FAX:(408) 335-9121.* Or circle Reader Service No. 203.

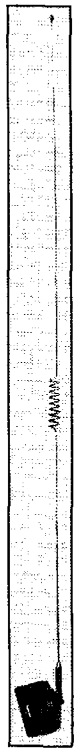


M.M. NEWMAN

The Antex TCSU-1 from the M.M. Newman Corporation is a temperature-controlled soldering station that can be supplied with a standard size iron or a miniature soldering iron and a selection of precision tips in a variety of shapes. It features a sliding potentiometer with a 1-to-10 setting to maintain the desired soldering tip temperature from 160°F to 815°F, with ±2% accuracy. Offered with a 40W standard size or 30W miniature iron, the tip is positively grounded and zero crossing electronic switching eliminates RF interference and magnetic fields. The Antex TCSU-1 Temperature Control Station is powered by 115 VAC and converts the voltage to 24 VDC. A sponge tray with a stable metal base and spring holder conforming to DOD-STD-2000-1B is provided. Both irons' heating elements are under the tip for optimum thermal efficiency and recovery times.

The Antex TCSU-1 sells for $205.43. For more information, contact *M.M. Newman Corporation, 24 Tioga Way, P.O. Box 615, Marblehead MA 01945; (617) 631-7100, FAX: (617) 631-8887.* Or circle Reader Service No. 207.

LARSEN



Larsen Electronics has announced the new Kūlglass™ KG 2/70 dual-band on-glass antenna designed for mobile radio users who require simultaneous VHF and UHF mobile communications over wide bandwidths. The KG 2/70 operates as a half-wave antenna on VHF and a collinear on UHF, and provides 2.5 dBd and 4 dBd gain respectively. Each antenna is individually factory-tuned to cover the 2 meter (145–148 MHz) and 70 centimeter (442–448 MHz) FM bands at 1.5:1 VSWR. The antenna's patented impedance-matching circuitry is on the outside of the glass to insure the best performance.

For the price and more information, contact *Larsen Electronics, Inc., P.O. Box 1799, Vancouver WA 98668; (206) 944-7551, (800) 426-1656, FAX: (206) 944-7556 or (800) 525-6749.* Or circle Reader Service No. 206.

HAMTRONICS

Hamtronics, Inc. has just printed a new catalog of their popular VHF and UHF modules. The catalog includes both kits and wired/tested modules for FM receivers, exciters, and power amplifiers used for building repeaters and control and telemetry links. Also included are receiver preamps, receive and transmit converters, autopatches, DTMF controllers, and accessories. The new January 1992 issue features new versions of the REP-200 repeater, including economy models in kit form and models with no controller which can be used with external controllers from ACC and others.

For your free copy, contact *Hamtronics, Inc., 65F. Moui Rd., Hilton NY 14468-9535, FAX: (716) 392-9420.* Or circle Reader Service No. 205.

Number 18 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Packet

Did you miss me last month? I'm sorry about the absence, but sometimes the pressures of work (I am a physician in an active medical practice) and family (a wife and four children) get in the way of my hobby! So, having let some issues build up, let's get right to them this month.

Phil Eastman, of Augusta, Georgia, writes:

I'm confused and frustrated!! I'd like to get into packet, and have heard many wild stories concerning equipment "needed" to get started, etc. In fact, I'm not really sure what packet is or does.

I've heard a Commodore 64 does a fine job and is highly recommended—by some—while others insist on an Apple. Is the only way to go with disk drive, printer, mouse, monitor, etc.? The PK-232 does a fine job also—then there is the new MFJ?!?

I'd like to work HF/VHF. My gear is not new, but it does a good job—Kenwood TR-7950 2 meters, Ringo Ranger (non-rotatable), VIC-20 computer with Kantronics interface, Kenwood TS-820 with quad on 40, and a trap vertical on 10-15-20-40-80.

My funds are somewhat limited, but I'd like to have good or middle-of-the-line equipment. I know the VIC-20 is a toy compared to all the new stuff on today's market.

Well, Phil, let's try to address your needs piece by piece. First of all, "packet" is a protocol of transmission, much as SSB or RTTY are other such protocols. The difference is that, unlike most other modes, packet is an interactive, error-correcting method of sending and receiving data which, at its best, allows flawless transfer of information, and at its worst, slows data exchange to a crawl.

A simple way to view the difference is by calling most other amateur transmissions "First I Send Then You Send." Whether on CW, SSB, FM, or conventional RTTY, this FISTYS technique is the same. One station sends information, and the other station replies with information of its own. While a repeat of information may be requested, it is the operator asking for the information. Frequently, small gaps and errors in transmission are filled in by the operator's brain. Thus, "MY QTH IS BJLTIMORE" is readily understood by most folks, without the need for further clarification.

In contrast, packet, and a related mode called AMTOR, might be termed "First I Send Then You Tell Me If It's OK Before You Send." Our new acronym tells us the sequence of activities here. A "packet" of information is sent by one station and received by a receiver. The receiver applies certain rules to the received information, which allows the detection of the presence of, although not the direct correction of, errors in information exchange. If errors are found, a repeat transmission is requested from the sender. Put it all together and, I guess, it spells FISTYTMIIOBYS! (Snappy acronyms are not my forte!)

By the way, you might have noticed that I have referred to the contents of the packets as just digital information. You see, they don't necessarily have to be just text, as with other digital modes. Transfers of programs, graphics, and about anything else that can be digitized is possible. So, you can see the power of this mode!

Next, is there packet activity in your area? Your 2 meter gear should be fine for packet, presuming that you are able to operate in the 145 MHz range of most VHF packet. Why not just tune the receiver to 145.03 or 145.01 (or another local packet frequency discovered by asking around) and let it sit there for an evening? If you hear short "brrrrp" transmissions on frequency, you have discovered a local packet frequency. I, for one, would hesitate to invest money in a station without at least some local activity!

As far as HF activity goes, my standard for equipment from earliest RTTY days has been that if the station is adequate for SSB, it is fine for digital communication as well. Yours certainly seems just fine.

Invest in a Controller

Getting onto packet with the VIC is less of a problem if you are willing to allow a multimode controller to do all of the work. Yes, I know that this will require a capital investment, but with one piece of new gear you might just be able to accomplish all you desire. Now, you knew you were going to have to buy *something*, didn't you?

There are software solutions to packet, including some that require little, if anything, in the way of hardware, but I have not found any that would run on a VIC. If you are going to upgrade, my inclination at this point would be toward an IBM™ PC compatible computer. With the usual complement of hard drive, graphic display, and the vast array of available software, this would seem the logical choice (sorry, I just finished watching Star Trek).

You did ask which controller, and

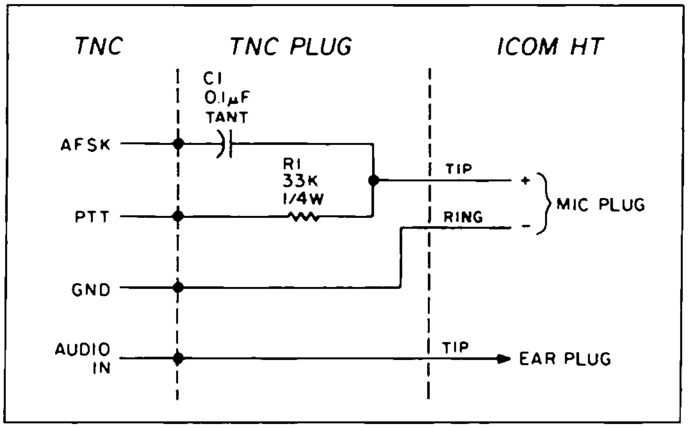


Figure 1. The interface to an ICOM HT with PTT keying, from 73 Amateur Radio Today, *February 1989, page 76 (by Dick Peters WA1PWF).*

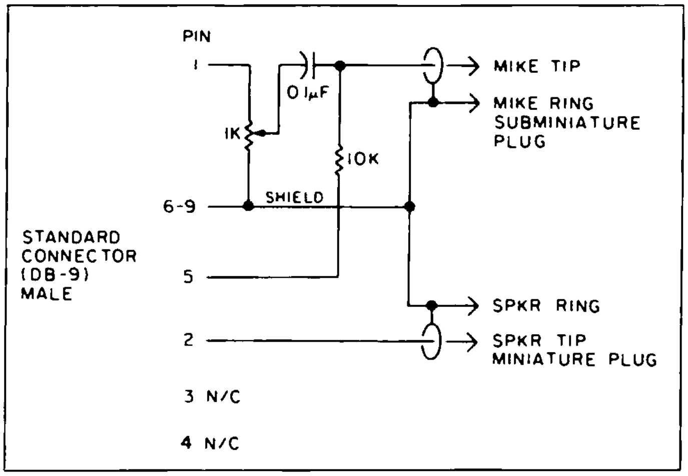


Figure 2. TNC interface to an ICOM HT with PTT keying and volume level control, from 73 Amateur Radio Today, *October 1989, page 41 (by Brian Lloyd WB6RQN).*

here I'm going to have to beg the question. I have only played with a limited assortment of packet controllers, and those with software that was first edition. Much of what I have seen is now obsolete! Things sometimes move so fast in this hobby. Clearly, the two manufacturers mentioned above both make fine equipment, and there are others, as well. My advice is to write for full specs on anything you would consider, and try to find a local source for the equipment, so that you can get some "hands-on" experience before you buy. Lacking a store, ask around to see what others in your area are using, and use that information to aid you in the decision process.

Above all, take your time, and consider your options. With money as tight as it is in all corners these days, shelling out several hundred dollars on something which is not quite right can be painful. Packet is not going to disappear tomorrow. Investigate, cogitate, ruminate, allocate, then get on the air and have a ball.

Another of our readers tried to do just that, and ran into a snag. Herb Raemsch WA3HGT of Montoursville, Pennsylvania:

I had this idea of hooking my IC-2AT handheld up for CW and RTTY. The terminal is an MFJ-1224 with a Commodore C-64 computer. Now, the 2AT has an external jack for audio out and a jack for the mike. I do not know how they key up the transmit side and feed the audio down the two same wires. Is there a circuit for this or do you know anyone who has used this handheld for CW or packet?

Well, Herb, I know that several of these rigs use a capacitor to decouple the audio from the DC keying line. There are several circuits which will accomplish this, as described on page 76 of the February 1989 issue of *73*, page 41 of the October 1989 issue, and page 49 of the August 1987 issue. See Figures 1 and 2 for two possibilities.

We have more on tap for the coming months, including some more RTTY software for the PC crowd, and a new source of amateur radio software for users of several popular computers! Above all, let me hear from you by mail, at the above address, on CompuServe (ppn 75036,2501), Delphi (username MARCWA3AJR), or America OnLine (MarcWA3AJR). E-mail is normally answered a bit quicker than the postal service variety, but I do try to respond when I can. If you desire a written response from me, or any other *73* author or columnist for that matter, a stamped, self-addressed envelope (SASE) is the rule. Thanks, and I'll see you next month in RTTY Loop. ■

ATV

Ham Television

Bill Brown WB8ELK
%73 Magazine
Forest Road
Hancock NH 03449

Touch-Tone Decoder

Last month we looked at the touch-tone decoder board designed by Bill Kinton NX1D. Thanks to the efforts of Fred Reimers KF9GX of FAR Circuits, you can use the following PC board foil patterns to easily reproduce the decoder board. An etched and drilled board is available for $9.50 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Although the board is designed to plug into a 44-pin edge connector (RS# 276-1551), you can just solder directly to the edge pins if you like. If you modified a TC-70 ATV transceiver as in last month's column, just slide this board directly into the connector and you're ready to go.

Versatile Circuit

The circuit is designed to switch on two different items (such as an ATV exciter and a separate amplifier) as well as switch between two different video and audio sources.

To use the decoder as a stand-alone circuit, just feed your #1 video source into edge pin 22 and the #1 audio source into pin 18. The #2 video signal goes into edge pin 20 and the #2 audio into pin 16. The selected video comes out on edge pin 21 and the audio signal on edge pin 17.

Edge pins 5 and 7 are open collector outputs which can be used to control low power circuits (don't exceed 200 mA current drain). To control higher current loads, just use these outputs to key a relay.

Edge pins 8 and 9 are extra logic outputs that you can use for expanded control functions.

Corrections

There are two corrections to be noted in last month's schematic diagram. Capacitor C4, the 1 µF tantalum capacitor should have its plus side going towards the audio coming from the control receiver. In addition, the line coming from the 4514 "*" line to IC3A should be labelled (19) instead of (14).

Although the circuit works just fine as shown in the schematic, to route the PC board traces most efficiently a couple of flip-flops and analog switches have been exchanged. The end result on the edge connector remains the same, however. If you've hand-wired your circuit, there's no need to redo it! I'll list the following changes so you can compare the PC board to the schematic: The 4013 gate labelled 2A is now 1A. In addition, some of the pinouts on IC6 (the 4066 analog switch) have been changed. Pins 1, 2 and 13 are now 11, 10 and 12. Pins 10, 11 and 12 are now 1, 2 and 13. Finally, pins 3 and 4 have been swapped.

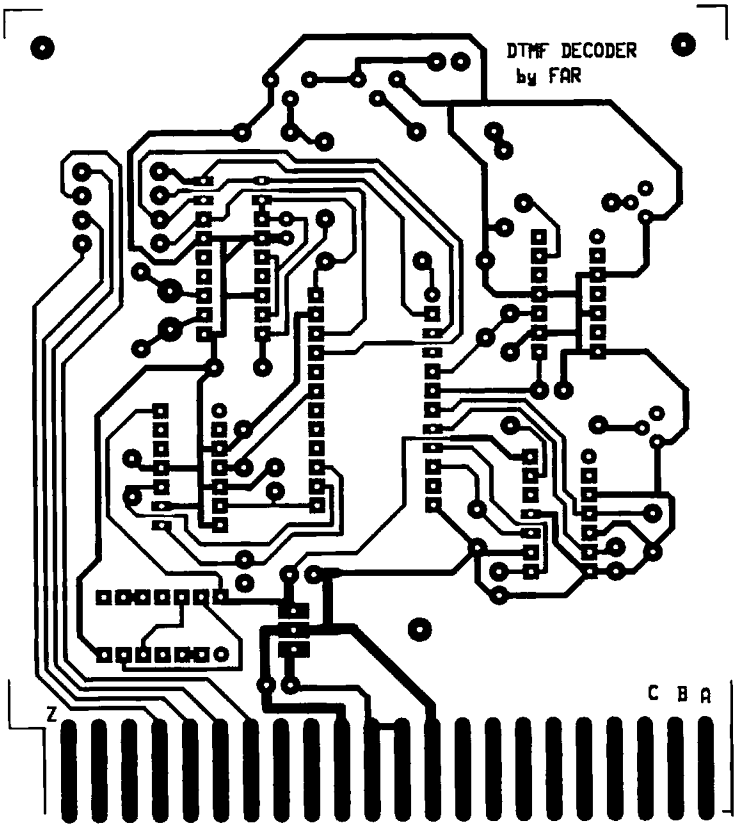


Figure 2. Touch-tone decoder PC board foil pattern (bottom layer).

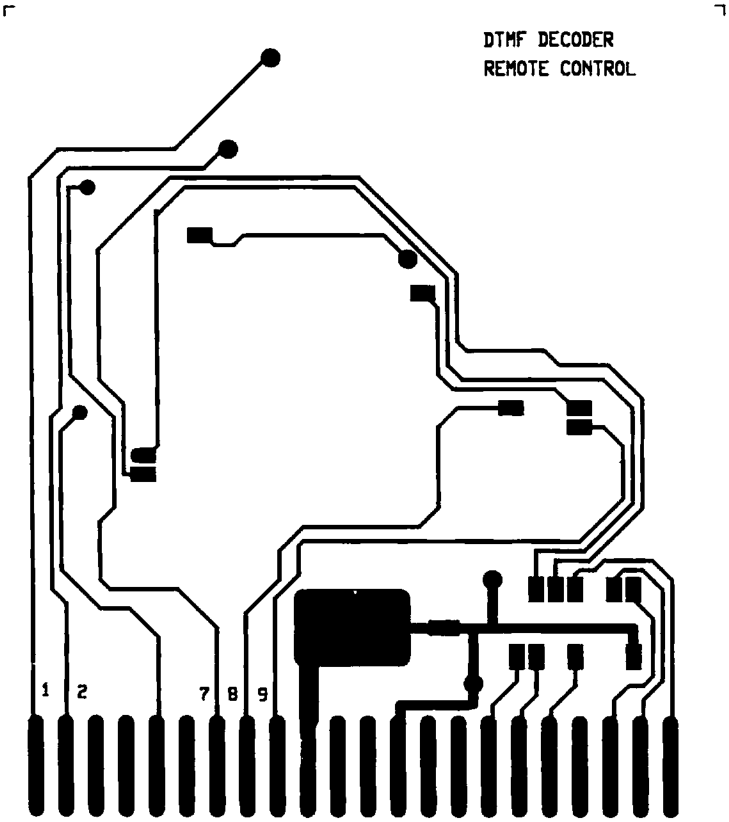


Figure 1. Touch-tone decoder PC board foil pattern (top layer). Solder all pads and pin locations shown on this side.

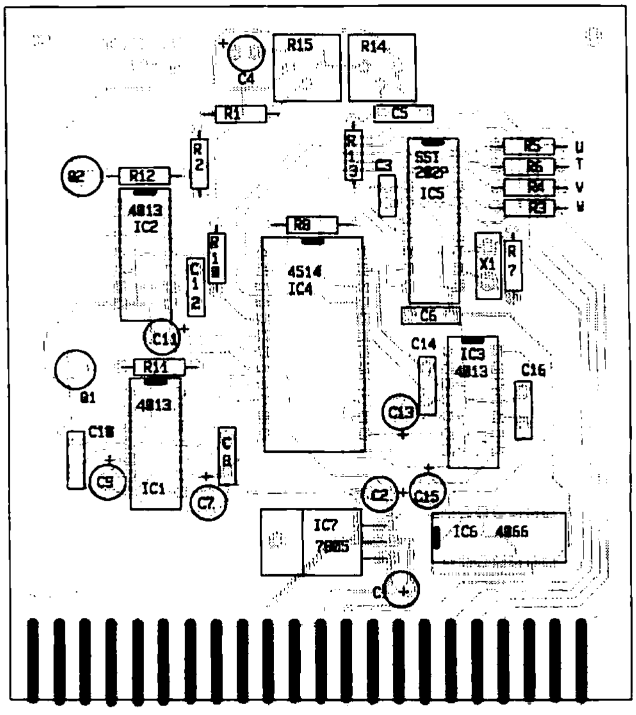


Figure 3. Parts placement.

Assembly Hints

Since this is a double-sided board, wherever there is a pad or pin location on the top layer, it needs to be connected with points on the bottom layer. However, the board doesn't use plated-through holes, so not only will you have to solder the pads on the bottom layer as usual, you will need to solder the pads shown on the top side as well. It's a good idea to use machine-tooled Augat style IC sockets, or leave some room between the bottom of the socket and the board, so you can easily solder the pins on the top and bottom sides.

Operation

After you're finished with the assembly process, just hook up your control receiver and power up the decoder board. Now just set your control receiver to about half volume and adjust R14 for reliable decoding. See the sidebar for the possible ON/OFF command sequences. R15 can be used to route the control audio on to another transmitter or to the ATV transmitter subcarrier. You should now be in complete control! ■

Decoder Command List

TT#	Output
1	Q1 ON (turns on transmitter or relay)
2	Q1 OFF (turns off transmitter or relay)
3	Audio/Video #2 selected
4	Audio/Video #1 selected
5	Q2 ON (turns on amplifier via relay)
6	Q3 OFF (turns off amplifier via relay)
A	Auxiliary output on edge pin 8 high
*	Auxiliary output on edge pin 8 low
C	Auxiliary output on edge pin 9 high
#	Auxiliary output on edge pin 9 low

Number 20 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

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10 GHz Gunn Oscillator Cavity

With more time in these winter evenings to build projects, I thought I would detail a 10 GHz construction project that can be quite useful. It sports a varactor controlled Gunn diode oscillator cavity. I have built several of these units from information provided by Chuck Swedbloom WA6EXV, who worked out the details presented here.

This cavity oscillator is intended for wideband FM. This is compatible to the Solfan burglar alarm units with the exception that the Gunn diode is operated from fixed voltage. The varactor in the cavity is a variable voltage capacitance diode (varicap), and shifts the frequency as the voltage to it is varied from 0 to 10 volts. Construction cost is minimal for the Gunn diode and waveguide parts. The varactor is, however, somewhat expensive if you can't find it surplus.

Construction with Solfan Devices

This cavity can be constructed with a drill press and ordinary hand tools. See Figure 2 for a list of tools (taps and dies needed). One of the items, a 3/48 tap, is not common, but is available in better machine shops. This tap size is standard for a lot of microwave devices, including the varactor and Gunn diodes I used.

Possibly a brief history of 10 GHz units might be in order. Normally, for low cost operation 10 GHz Gunn transceivers were constructed using a Solfan or similar type burglar alarm, or a door opener microwave device. Cost was about $5 to $20 each, with availability in most larger cities. The primary difficulty with the simple Gunn transmitter using one of the Solfan devices was the method ol frequency adjustment. You had to vary the voltage of the Gunn oscillator in order to make small changes in frequency.

This Gunn voltage varied from about 7.5 to 9.5 volts, and resulted in a change in frequency of about 5 to 10 MHz or so at 10 GHz. The only other frequency adjustment was mechanical and touchy to adjust in the field. By substituting the varactor controlled cavity for a Solfan device the Gunn oscillator is run at a fixed 10 volts. This improves basic stability and makes fixed mechanical adjustment something to be set in the home station. Modulation and variable voltage is now fed to the varactor instead of to the Gunn device as in Solfan units.

Varactor Diode

Selection of a suitable varactor from surplus is touch and go. You have to try them out and see what happens. Most varactors will work, but the frequency spread per voltage tuning range will differ. If you can locate a varactor that will give you a 50 to 60 MHz tuning range, it will make wideband FM (WBFM) operation a lot smoother.

For example, you can set up two WBFM 10 GHz transceivers for full duplex operation with each other. One station must be 30 MHz different in frequency on transmit from the received station's own transmitter. Frequencies commonly used are 10.220 GHz, 10.250 GHz, and 10.280 GHz. This assumes a 30 MHz IF system in common use. Operation on other IF frequencies are just as possible; 10.7 MHz and 88 MHz have been used.

By having varactor control, you can vary a DC voltage that adjusts the cavity quite accurately, and you do not need to spend lots of time re-calibrating. Instead, you re-set the varactor voltage to a calibrated frequency/voltage reference. In contrast, much time was needed to calibrate the frequency in the single Solfan units, due to the narrow adjust frequency of the Gunn diode. This made mechanical adjustments in the field necessary. Another benefit of the varactor controlled unit is that the Gunn diode is optimized for maximum, as it is now running on a fixed voltage supply.

Varactor control gives a swift method of frequency adjustment in the field. When used in conjunction with a beacon, frequency errors can be almost eliminated on field operations. To calibrate your frequency using a beacon, aim your system at the beacon, and if it does not agree with your previous chart, make a small mechanical adjustment. Thereafter refer to your frequency/voltage chart for operations. In this way the varactor system and beacon confirmation go hand and glove with each other, setting a frequency standard for the area of interest. Many stations that can copy the beacon can use it to set the frequency without expensive test equipment.

Cavity Construction

Construction of the cavity is straightforward. The unit is built on a piece of bar stock that acts as a base and heal sink (see Figure 1). The cavity itself and varactor diodes are mounted in small holders in the bottom of the unit. Electrical connection to the diodes is provided through bias chokes. Frequency operation is determined by two main factors: the physical dimensions of the cavity and the capacitance of the varactor diode. The 6/32 COARSE TUNE screw moves in and out of the cavity, changing the physical dimensions and center frequency.

The voltage on the varactor diode varies its capacitance, giving a frequency spread of upwards of 60 MHz (depending on the diode used). Construction of the cavity is not difficult if the work is taken in steps to ensure proper fitting prior to final assembly and soldering. Care must be taken not to allow any solder to flow into the cavity during assembly. Solder acts as an attenuator and must be removed. Either soft or silver solder may be used, but you'll find soft solder easier to work with if you need to correct a part mounted in error. None of the cavity components are difficult to obtain, and can be found in a well-stocked hardware store.

The quantity and size of the brass needed for this project are such that the possibility of making them out of scrap stock is good. Once the necessary parts and tools are collected, construction can begin. The heat sink is made larger than the waveguide to provide extra capacity for a high power Gunn diode. Use a piece of brass 1" x 1/4" x 2" long. A piece of brass 1/8" to 3/16" serves as the waveguide flange, which will allow mounting to a feed horn.

The very small RF bias chokes can be turned on a lathe (Figure 2) or assembled from pieces of stock as shown in Figure 3, which were constructed on a drill press. Using a hacksaw, I cut

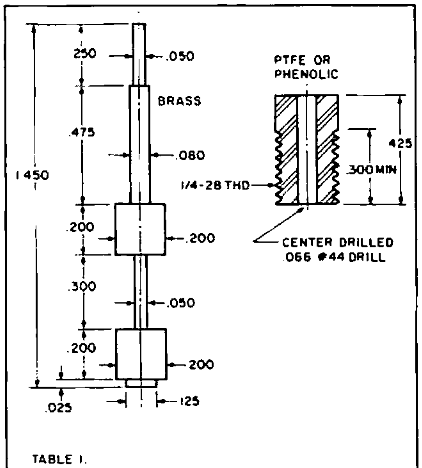

TABLE I.

TAPS	DIE	DRILLS
3-48	1/4-28	#3
6-32		REMAINDER
10-32		STANDARD
1/4-28		DRILL SET

Figure 2. Construction details of the RF bias choke and choke retainer.

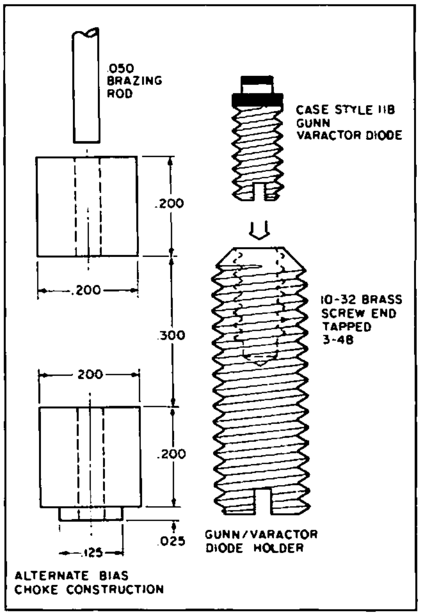

Figure 3. Alternate construction method of the bias choke. Drill out the center of some 0.200" stock to fit 0.050" brazing rod and solder as shown. A diode holder can be built as shown.

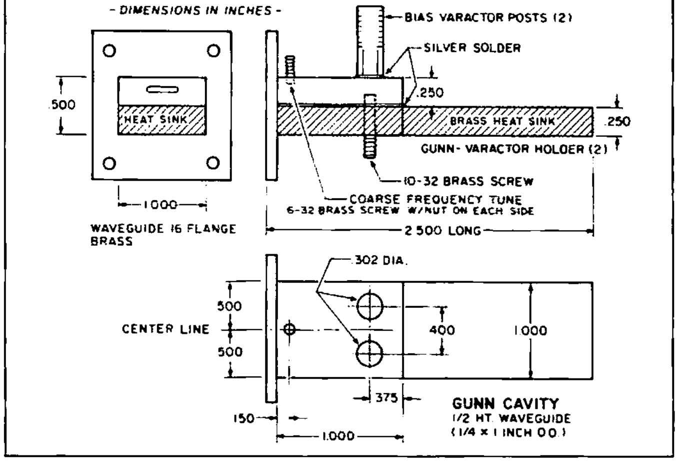

Figure 1. The 10 GHz cavity; front, side and top views.

short pieces of 0.200 brass rod, and drilled these through the center with a 0.050 bit. Inserting a brass brazing rod through each hole completed the chokes. The bottom of the choke should be turned down to 0.125", and should be smooth where the chokes meet the diodes. The RF chokes were then soldered, which proved just as satisfactory as the lathe-produced chokes.

Photo A. Paul N1BWT and Matt KB1VC operate from Jay Peak, Vermont during the 10 GHz contest.

The hardest item to obtain is the "half-height waveguide" (Figure 4). If you can't find one, you can make it out of a short piece of standard waveguide. Use a hacksaw very carefully, making clean cuts. Any piece of brass waveguide can be cut open to retrieve the 1" piece needed. The half-height section of waveguide is then soldered directly to the top of the heat sink, taking care to keep solder out of the cavity. Once soldered to the heat sink, there is no difference between it and an actual piece of half-height waveguide.

Bob W6RHV came up with this method, and we've used it very successfully. Now that the cavity and heat sink are assembled into one solid assembly, the holes can be drilled to allow total alignment between between the Gunn/varactor screw holders and the upper RF choke bias posts. Proper alignment is Important here. Keep two points in mind. First, don't use a center punch. This can deform the soft brass of the cavity. Mark the holes with a scribe and start all holes with a very small drill bit. Move up to larger bits as needed. This prevents the larger bits from wandering, which would change alignment.

Once the small pilot holes are drilled, the next holes to be drilled are the bias posts. These holes should be drilled through the top of the cavity and down through the heat sink in one motion, ensuring proper alignment. The drill used should be the proper size for the 10/32 tap. The heat sink is then tapped to accommodate the 10/32 diode holders. Now drill out the holes in the cavity top to 0.302" to accept the bottom recess of the bias posts.

Finally drill the hole for the tuning screw and tap for 6/32. A 6/32 nut is soldered over the hole to provide additional threads for the tuning screw to bite into, for a tight fit. The bias posts are made from the 3/8" solid brass rod cut to about an inch. They are drilled through the cent?r with a #3 drill. Again, start with a smaller bit and work up to #3 bit Drill completely through the rod, and finish its length to 0.950". The top portion of the bias posts are threaded with a 1/4-28 tap, to a depth of 0.400" This thread will accept the bias choke retainer, which is made from 1/4" insulated rod and threaded with the same 1/4-28 thread.

The bottom of the bias post must be reduced to allow it to fit into the 0.302" hole in the cavity. This is done by placing the post in the chuck of a drill press, and using the drill press as a vertical lathe. Using a small file, turn the edge down from 0.375" to 0.302", so that they fit tightly into the top of the cavity. The tight fit holds the posts in place while soldering, maintaining proper alignment. Both bias posts are prepared in the same manner.

Take the finished bias chokes and insulate them with a single turn of mylar or Scotch™ tape. Insert them into the bias posts to check the fit. They should fit through the posts with little friction. Once all the necessary fitting has been checked and rechecked, solder the posts to the cavity. At this point, the waveguide flange can be soldered to the assembly. The output slot, or iris, can now be drilled. This is easily accomplished by scribing a line and drilling a series of 1/16" holes along it.

The material between the holes is filed out to form a perfect slot. (In actual operation, I've found that more power can be coupled out of the cavity by enlarging the slot slightly in the center.) This is a custom adjustment peculiar to each device. Don't enlarge this hole too quickly; work in small increments. If it's too large, it will over-couple, and a new front plate will need to be constructed.

Check the alignment of the center of the bias posts and the 10/32 diode holder screws. Ensure that they are in perfect alignment. Insert the bias chokes, with the insulating tape, and position with the choke retainer just entering the cavity top by about 0.050". The Gunn and varactor diodes are inserted in the holders one at a time, to check for proper contact with the diodes and chokes. I suggest using a "DUD" until all fit OK, lest you damage a good device. Check for shorts. When all is well, seal off the end of the cavity with a section of brass stock.

Testing the Cavity

To test the cavity, use a closed environment. Connect the cavity to a waveguide attenuator with either a dummy load (waveguide type) or a directional coupler, to allow sampling of output power. (Always prevent stray radiation from escaping from the unit. Never look into the open end of a radiating waveguide. The eyes are susceptible to microwave damage—SAFETY FIRST—!!)

Frequency is set by varying the position of the coarse tune screw, and varying the voltage on the varactor diode. This will set your varactor tuning range, first mechanically then electrically. If you use surplus varactors, the amount of tuning excursions will vary with the type of varactor used. You will have to experiment to find the device best suited to your cavity.

The varactor diode I used was obtained surplus, and had a capacitance of 0.35 pF. Several types performed well. These were all similar to Microwave Associates part number MA-45225, and parts #46602 thru 46604. These devices are rated at approx. 30 volt breakdown 0.5 pF, 10 to 12 GHz operation. All parts are available in many case styles, with case 30 (drop-in package) and case style #118 (3/48 thread) mount. See Figure 3, case #118 style.

I can supply Gunn devices for this project. Fifty mW Gunn diodes are $5 each, and 100 mW devices, $10 each, postpaid U.S. destinations. I am running out of the 100 mW devices, as they are harder to gleen from existing stocks that the 50 mW types. If I come up with some suitable varactors, I will let you know.

New Products

Waveguide 16 (1" x 1/2" O.D. brass) has, as you know, been difficult to obtain in small quantities for amateur use. However, Ed Emich of Emcom Industries is willing to make small quantity purchases of both waveguide 16 and waveguide flanges. Flanges cost $4 each, and the brass waveguide is priced at $4 a foot plus shipping. This should rescue quite a few microwave construction projects waiting for materials. Contact Ed at Emcom Industries, 10 Howard Street, Buffalo NY 14206. Tel (716) 852-3711.

As always, I will be glad to answer questions relating to our VHF/UHF microwave frequency bands. Please enclose an SASE for a prompt reply.

73's, Chuck WB6IGP.

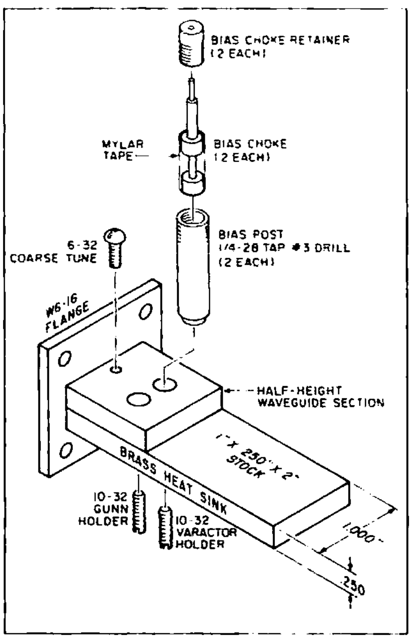

Figure 4. The complete 10 GHz varactor controlled Gunn oscillator cavity.

Number 21 on your Feedback card

QRP

Low Power Operation

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The Joy of Tinkering

If there is one thing I really enjoy about ham radio, it's tinkering. I can spend hours on end working on a circuit, and accomplish nothing when I'm done. But the time was not entirely wasted! I've learned a thing or two about electronics in the process, even if all I got done was smoking transistor after transistor. Every time a transistor goes up in smoke, I learn a lesson. This is the way we all learn, from our mistakes. So, what does this have to do with QRP? Plenty.

Sometimes when tinkering on the workbench with a circuit, I can find a better or unusual way to do something. I enjoy looking over a schematic for a project and seeing something I can use in a different application. A good example is the two part series in *73 Magazine* on the computer controller for a repeater ("Microprocessor Repeater Controller," October and November 1991). Nothing there about QRP, but if you look over the schematic, you'll see the use of 4066 ICs for audio switching. Hmmm. . . . This part of the circuit can then be changed a bit here and there, and used in a receiver for audio muting or sidetone injection. To see just how well the circuit will perform, you can build just the portion you need and test it out. This is what tinkering is all about.

Using Perfboard

In the past, I used to tinker using perfboard. This always worked and still works today. But it does have its drawbacks. First, it's a real pooper to change parts. If you want to change the value of one resistor, you have to unsolder the old one and solder in the new one. No big deal, but after a few times of doing this, you end up with a messy perfboard project. The resistor is not in the best shape, either!

I also find it hard to keep track of what is going on from the top of the board to the bottom. Sounds like no big deal, until you have several IC chips scattered about with wires running on both sides of the perfboard. It then gets very confusing to keep track of what goes where.

Working on RF circuits brings out another problem—ground leads running all over the place; lines carrying RF getting too close to Vcc lines; inputs too close to outputs; and the list goes on. This mess is all too easy to do with perfboard. Tinkering with RF circuits on perfboard does not make for a happy camper.

Coming Unglued

I tried using a piece of double-sided copper-clad PC board for RF circuits, thinking the ground plane would keep the RF happy. A piece of PC board material 4" x 6" was acquired. Using a hacksaw blade, I made a horizontal and then a vertical cut every 1/2" all over the board. I ended up with a checkerboard pattern. Each 1/2" piece of copper was an island, not connected in any way to the other islands. I had the bottom of the PC board for a ground plane, plus all the connections were done on the top of the board. No more flipping back and forth from top to bottom. Didn't work worth a hoot!

Here's what happened. After working on the circuit for a bit, soldering in and out parts as I changed the design from the schematic, the board started to bow. This was from the heat of the soldering iron and the solder itself. The large blops of solder had a tendency to bridge over to another island, causing a short. I constantly had to suck up ex-cess solder from the islands. Some of the copper islands became unglued from the board by the heat and simply fell off.

Some of my little islands did not cut all the way through, and therefore were still connected to one or two other islands. I had to go through all the squares with an ohmmeter and find the shorts. (After spending many an hour trying to find out why the circuit did not work.) Needless to say, I was not impressed with my solution. Looking back, it seemed like a good idea. It still might be, but the 1/2" islands are too big. A good size might be 1/4" islands. It would be too much work to hand cut these with a hacksaw blade, but you might be able to use a motor tool with a grinder head.

ProtoBoard

For tinkering with RF circuits today, I use a combination of the perfboard and PC island board. But for digital, analog, and some simpler RF circuits, I use a product called ProtoBoard™ by Global Specialties. There are other companies who make something like the ProtoBoard, but the one by Global Specialties is probably the best known.

So what is a ProtoBoard? It's a breadboard with thousands of tie points. Some connect in rows, others are by themselves. The ProtoBoard I use has about 3500 tie points. I got mine from Radio Shack about 10 years ago, and it's still going strong. With the board, I can change a design as fast as I can think. Want to change a 10k resistor to a 15k? No problem! In and out just like that, and it's done. No soldering, no fuss. These things are great for IC chips. The board I use can hold up to 25 or so ICs.

I purchased a sloping panel box from Radio Shack years ago and mounted the board to it. I was going to add a small power supply inside, but never got around to doing it. The sloping front allows me to work on a project without eye stress. Just the thing for those late night tinkering projects.

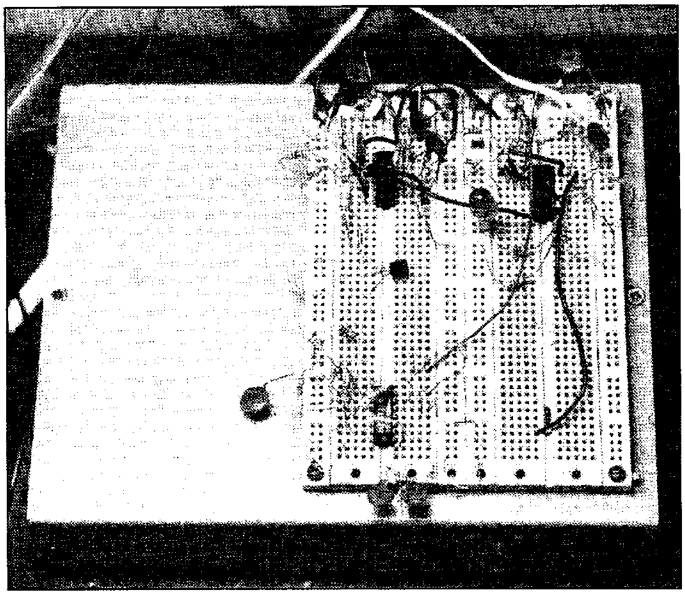


Photo A. ProtoBoard, made by Global Specialties, is great for trying out simple circuits.

Since Radio Shack still sells the breadboarding strips, you could fashion a similar system of your own. A hunk of aluminum from a 19" relay panel would make a good start for a base. The 1/8" aluminum is lightweight but very strong. Add some binding posts and you're done.

Of course, if you have the money, you could always get one ready made. Expect to spend about $29.95 on up, depending on the options and number to tie points.

Many of the circuits developed for the QRP column have come from the breadboard I described. More will be coming, I'm sure!

So, as you can see, you don't need special test gear or a work bench to become a world class tinkerer. All you need is a cold Saturday night, a plate of Oreo cookies, and some Diet Coke. My old cat, Bert, likes watching those little white whisps of smoke coming from a NE602. When he's purring and watching the smoke, I know I'm tinkering—world class. It just don't come any better than this. What a country!

Never Say Die

Continued from page 4

My instructor familiarized me with all the instruments and I was ready to give it a try. How could I possibly remember to do all those things at once? Well, taking off was pretty easy. We taxied along, gaining speed until we were doing 149 knots. I pulled up the nose, eased the flaps, pulled up the wheels and we were on our way.

At 3,000 feet I started making some turns to get used to how she handled. It was like steering an ocean liner. I put on some rudder to get her turning, then I moved the rudder back to neutral and waited until we'd almost hit our new course. A slug of reverse rudder put her on target. Ooops, I forgot to watch my altitude and I was 300 feet higher than I wanted. I eased her back to 3,000.

I made a few more turns, getting the hang of the beast. Sherry and Scott were sitting behind me, along with Capt. Chevallard. My instructor, Capt. Beale, made it easy. I never even felt nervous! It was just fun... and incredibly real.

We then went into a landing pattern and headed for the runway. It was a night simulation, so I could see the runway's flashing lights from about 30 miles away and headed for them. I've only flown a few land planes, so getting my plane into the right glide slope and making the last two turns of the landing pattern have never been easy for me. I was busy watching everything at once... the runway, the altimeter, the glide, the heading and so on.

My old plane was a seaplane. It was practical for me at the time. I lived just a few minutes from a small seaplane base in Brooklyn (NY). If I'd flown with wheels I'd have had to drive an hour or so to the nearest airport.

The seaplane was great fun. I took my 2m Communicator with me and talked all over the East Coast. I often flew up to New Hampshire and dropped into several of the lakes to visit. I visited my folks in Bethlehem, NH, landing at Long Pond, nearby.

Much to my surprise the first landing, with Capt. Beale helping considerably, came off fine. Nice touchdown and runout. The nose wheel steering control was as sluggish as steering a big boat too.

We tried a couple more takeoffs and landings, one landing in a dense fog with 100-foot visibility, and then, after only an hour, I was ready to solo. I moved over into the captain's seat and said, "Well, here goes!" Would I be able to keep this lumbering monster under control? Would I crash and burn? I pushed the throttle forward to 85% power and off we went. Much to my surprise it all went well. We got up to takeoff speed, went up, circled a bit and then came the hard part. We weaved a little, but I got her on course and into the right glidepath, all without automatic pilot, thank you. We touched down like a feather.

Well, if they ever ask on a commercial flight for an emergency pilot... heh, heh. Darn, I forgot to bring my pilot's log with me.

So that was my little coup for 1991 ...just before Thanksgiving. Not bad. Last year I was at the helm of a hunter-killer nuclear submarine cruising around 800 feet under the Pacific. Now what'll I do for '92?

When I got out of the simulator they gave me the printouts of my flights. What I'll never get over is the realism of the experience. It's visually and physically like real life in every way.

Capt. Chevallard had one more thrill set up for me. The next morning I got to meet his band and hear them practice. I've got several of their CDs, so I knew how good they were. But even so it was great being right there. Then the captain turned the baton over to me and let me lead the band through "The Stars and Stripes Forever."

Now I've been leading the finest orchestras in the world in my own living room, but this was for real! When I wanted pianissimo on the trombones, I got it. When I wanted 'em to hit the drums and cymbals, I got it. What a feeling of power! What a rush! Now I want an orchestra of my own.

Oh, I know it's impossible. I don't have the time to do everything. There's just too much. Yet I look at people younger than me who are retired and doing nothing and I get mad. What a waste! What a terrible waste. Playing golf indeed. Sure hamming is fun, but as a hobby, not as a way to mark time until death. Hamming is fun if you get on OSCAR... if you try SSTV... if you go on some DXpeditions... if you are on packet... win some contests. It can be fantastic fun. It's fun to get kids excited about it and to help them learn. I love teaching. That's exciting too.

But I'm not just standing on the sidelines cheerleading and holding coats, I'm out in front doing what I champion. You can put me down for bragging if that satisfies you. I'm saying here, life can be one hell of a lot of fun. Here, try this and try that. I'm almost 70 and I'm doing these things, so how about you?

Are you doing all you can do to stay healthy? Are you eating right? Stopped smoking? Laying off the six-packs? Are you walking at least a half hour every day? Briskly walking? Are you keeping your mind active, reading magazines and books? Are you giving the politicians calculated hell? Are you a spark plug in your ham club or are you just another invisible doughnut eater?

You can be healthy. You can have fun. You can even make more money than you need. And you can contribute to society in the process. So yes, I brag and tell you about all the wonderful things I've done, I'm doing and I'm going to do. I do it to try and get you to join me and have fun too.

I'm getting more and more letters from readers saying they're getting their clubs moving... they're getting more new hams licensed... they're losing weight... they're off cigarettes. I say great, now send me pictures of those new hams. Take some videos of all this and let me see what you're doing.

Stop by here in Hancock and say hello. Meet me at Aspen for some skiing. Meet me at Sedalia for some ragtime. Meet me at Dayton and give me a chance to harangue you for an hour and tell you how rotten you are and how you should shape up. Write and tell me how much fun you're having with packet... with moonbounce... with OSCAR and so on.

Send me some articles and pictures when you finally have the guts to break loose and go on a DXpedition somewhere. Write for *Radio Fun* and help get new hams to try RTTY, SSTV and other exciting ham adventures. And if you're into some new technology the rest of us ought to know about, start writing.

Have you tried facing 5th graders yet? I'll bet one of your local school principals would be delighted to round up some kids to listen to you explain what ham radio is and why they might have a ball if they got interested. You might wave an HT at them and get someone to talk with them over a local repeater. Get 'em fired up... then write and tell me how much fun it was so I can print your letter and use it to get others off their recliners.

So yes, I'm piloting C-5Bs, leading a band, helming a nuclear submarine, starting record companies, skiing, diving and telling New Hampshire how to run the state. So why aren't I retired, playing golf and blowing wind on 20m while I await my Silent Key listing? Because I'm having a whole lot more fun, that's why. How about joining me?

Aspen in February?

Chuck, Eric and others of our ham/ski group will be hitting Aspen February 1 for a week of fun. Even if you're a beginner, come on out and join us. We'll be talking ham radio, computers and stuff. I'll be talking music and a few other Interests too. Maybe we can work up some ideas on getting our hobby growing even faster than it is. I'd love to see it start to take off again, getting back to being a real industry.

I'd love to see hundreds of new ham stores opening. You know, we had over 850 good-sized ham stores back in the early 1960s. And we had hundreds of small ham entrepreneurial businesses. I'd just started *73* and knew everyone personally. Great bunch of guys.

In the meanwhile I think we're going to have a ball building up the American music industry... pushing music from independent music producers... pushing interesting and creative music, new and old.

There are some marvelous new rags being written. I'm putting together a CD of contemporary rags, with some by Scott Kirby, Dick Zimmerman, David Thomas Roberts, Joe Walsh and others. I can hardly wait for you to hear them! Scott played a couple at Fresno and the crowds went wild.

So, are you having fun? If not, why the hell not? It's sure out there to have, so it's only yourself stopping you.

Meanwhile I've been up to here working on my proposals for the New Hampshire Economic Development Commission. My report is almost up to 100 pages... and that's magazine pages, not typewritten... and I'm not out of steam yet.

I've covered some of my ideas in my past editorials. When I get done I'll get the report printed and make it available at cost. Who knows, you might be able to get some of my ideas going in your state and help your economy.

If New Hampshire goes for my educational plan we'll be cranking out thousands of new hams... maybe tens of thousands a year. And we'll be aiming them at high-tech careers so we can eventually reclaim our consumer electronics industries.

My proposals embody many good potential businesses which should be established. Dozens of them. Entrepreneurs should be able to go to their state governors and legislatures with business plans based on my ideas and be set up into any of several businesses which will bring big returns to their states.

I'm available for consulting, if you need some help. But remember, my time is limited. I want to go skiing, do some scuba diving, lead an orchestra, try sky diving, and so on. I'm almost 70, so if I don't get going on these things soon, it'll be too late!

My apologies to ham clubs and hamfests who'd like to have me come and talk. Fellas, I'm producing music in my new studio for Greener Pastures Records, my ragtime and bluegrass label... for Green With Envy, my rock and classical label... I'm starting some new publications... *Radio Fun* is taking off beyond our expectations, with over 10,000 paid subscribers already.

We're doing special inserts for business magazines like *Forbes* (see their Nov. 11th issue)... plus sampler CDs for them, the Rainforest Action Network and other special causes. We're making CDs and cassettes for over 50 different record companies. Our new distribution company is handling over a hundred labels. Our mail order music company handles 250 labels. Now how am I going to get away for hamfest talks?

Anyway, if you'd like more info on my sales rep plan... and your area hasn't been taken yet... let me know. Phil Martus will get you some poop. Write Phil at Creative Music Marketing, Forest Road, Hancock NH 03449; Fax: (603) 525-4423.

Supersonics

Reader Eisner from Colorado sent a clipping from *Science* (July 1991) you might want to think about. Seems there's been some surprising success in getting people to "hear" in the supersonic (40–90 kHz) range. It takes some power and you have to use bone conduction, not the ears. This even works for the deaf (now known as hearing-impaired). Heck, it even works with SSB! If you're adventurous you might want to check this out... if you can harness it, it's got great commercial potential.

Continued on page 76

Number 23 on your Feedback card

UPDATES

The Quag-V

See the above article in the **December 1991 issue, page 36.** Table 3 on page 40, listing the materials for the 8-element antenna, contains an error. See the last column, the one for 146 MHz. The boom length should be 14 feet, NOT 12 feet. The total correct dimensions should be 1" x 3" x 14'.

The Dual-Combo FSM and Source Dip Meter

See the above article by Martin Beck WB0ESV in the January 1992 issue on page 8. Refer to Figure 1 on page 10. Diode D2 should be reversed from what is shown in the parts placement diagram.

The "Cheap and Simple" Power Supply Revisited

See the above article by Vern A. Weiss WA9VLK/G0NBZ in the December 1991 issue. Refer to Figure 2 on page 66. Ray Mack WD5IFS points out that the voltage rating of capacitor C1 should be at least 35 volts instead of the 25 volt rating shown. In addition, the author writes: "There are three noteworthy corrections. First, the 2N3055 transistors are NPN devices, although they are shown as PNP on the 'new' schematic (Fig. 2). Secondly, resistor R3 was drawn as a variable resistor, but a fixed-value resistor would work fine. And finally, the full-wave bridge rectifier, illustrated with dashed lines around it in Figure 1, states 'see text.' Unfortunately, no mention in the text was made of this bridge in the latest article (it was described in detail in the original 1981 article). For this component, use a 25 amp, 50 PIV rectifier such as the Radio Shack 276-1185."

Project INSPIRE

See the above article by Jim Ericson KG6EK in the December 1991 issue. The *Beginner's Guide to Whistler Hunting* by Michael Mideke WB6EER and an audio tape of a variety of sounds that can heard in the VLF spectrum is listed incorrectly in the article as being available for $6. The guide is available for that price, but the audio tape is an additional $10. These items are available from Michael Mideke WB6EER at P.O. Box 123, San Simeon CA 93452-0123.

Computerized Tuning for Ramsey Receiver Kits

See the above article by Mike Gray N8KDD in the December 1991 issue. The program listing to control the interface was omitted. The program (see box, below) will produce an output voltage from the DAC board depending on the value entered (0–255).

```
10 PRINT "Control + Break to quit"
20 INPUT " Enter D/A counts (0-255) ", OUTCOUNTS
70 PRINT OUTCOUNTS
80 OUT 890,0              :REM WR line high
90 OUT 888, OUTCOUNTS     :REM data out
100 OUT 890,1             :REM WR line low
110 OUT 890,0             :REM WR line high
120 GOTO 20
```

Number 28 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525-4438, 8 data bits, 0 parity, 1 stop bit. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: Schematic and/or manual for Eico Model 625 Tube Tester. I will pay copying and mailing expenses. Thanks to all who responded to my previous requests. *Larry Keith KF8BX, 4251 Meadowsweet Dr., Dayton OH 45424. Tel. (513) 233-1148.*

Wanted: Manuals for Hallicrafter SX-100 and SX-111 originals; or will be glad to pay copy and postage. Thanks. *Milt Faivre K4EBT, Box 651032, Vero Beach FL 32965-1032.*

I need a schematic and operator and service manual for ICOM IC-211 2 meter all mode. Will pay all costs. Thanks. *J.Y. Lem KB6BO, 5222 Coringa Dr., Los Angeles CA 90042*

I am interested in donations of the following: PTO RX R390 Shortwave set; Realistic DX-300 (for Novice CW work on AM/SSB). I am also interested in products from Fair Radio and Universal Radio. Many thanks to anyone who can help. *MacArthur Moore Herman KA3LLY, 5230 Heston St., Philadelphia PA 19131.*

I am in need of a schematic for a Zenith, green screen monitor, Model ZVM-121, Chassis 12MB15X. I will be glad to pay for copying and postage. *Fred L. Horton, 4024 Oakland Blvd., Roanoke VA 24012. (703) 366-6266.*

Pearl Harbor

I was chatting with a chap on 160m out in Western New York when he mentioned he'd just heard that Pearl Harbor was being bombed by the Japanese. It was Sunday, December 7, 1941. By the next day we'd all been chased off the air. . .for what turned out to be four years. Four interesting, long years.

My ham ticket got me into the Navy as an RT3/c in 1942. After nine months of superb school I graduated as an ET2/c and went aboard the USS Drum in 1943. . .where I spent until 1945 making five war patrols and made ET1/c. Then I taught school on the New London Submarine Base until I was discharged in 1946.

That little paragraph covers a whole book of adventures and sea stories. Let's say I had an interesting time. I lost a lot of friends. . . you probably know we had by far the highest losses of any branch of the military, around 20%. Were there some close calls? Ask me sometime when we're in QSO.

In those days, being a ham meant a lot. It not only got me into a fantastic program in the Navy. I also found that all my instructors in the Navy schools were hams. There were long lists of calls on blackboards, carved into desks and all over the place.

That was when hams were automatically buddies. . .fraternity brothers. Eighty percent of the American hams went into the military. We were needed, young and old. Our equipment was needed too. My Hallicrafters SX-24 receiver ended up on the Amazon with the Rubber Development Corporation, an OSS operation.

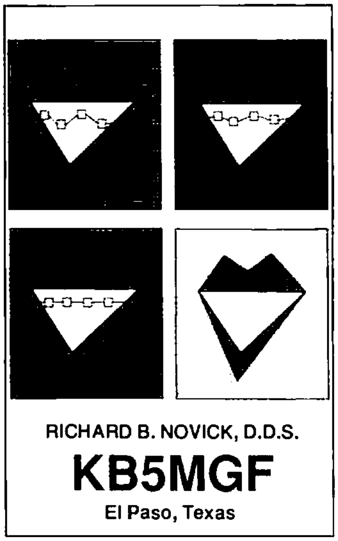
In our latest war they didn't want hams for anything. Further, our equipment is so far behind the current military communications technology they'd have no use for it.

Considering that when the lease on our ham bands came up for review in the past our biggest supporter was the military, we could find ourselves all alone against a big, bad commercial world. Of course, if we'd get into gear, fire up kids about hamming and start pioneering new technologies again, our lease would be easier to keep. The FCC doesn't want to know what we did for them 30 years ago. They want to know what we've done lately. . .and what we're going to do tomorrow.

IARN Disintegrating

The Intermidable Amateur Radio Nuisance (IARN) was, until recently, pretty much a two man show, with Hap Holly KC9RP cheerleading Baxter K1MAN in his megalomania. Hap's a nice chap. Blind (now known as sight-impaired). Hap's been providing a dial-up news service which Baxter has been using on his endless self-promotional broadcasts. Hap, who had a stronger stomach for Baxter than most of us, finally got fed up and split.

Say, you can do me a big favor, if you will. Please check with the members of your club and see if any of 'em are listening to the K1MAN broadcasts with any regularity. Does Baxter have any listeners? Please advise.



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

Dayton '92

Are the members of your club planning on a mass invasion of Dayton this year? You'd better make your plans soon since it starts April 24th. Are you driving or flying? Where are you going to stay? What channel will you be using to keep in touch?

If you wear an "I Hate Wayne" tee shirt I'll give you a $2 discount on a renewal subscription. Say, what did you do with your *73* hat? You're going to wear it while you walk past the *CQ* and *QST* booths, right? And don't forget to congratulate *CQ* on their *Ham Radio* takeover.

Good Old Hiram!

You all know about some old geezer named Hiram Percy Maxim starting the ARRL, right? Jeesh, I hope you know about that. The pity is that you don't know more about old Hiram. . .now there was one hell of an entrepreneur! Hiram was not only a pioneer in amateur radio, he was also one in film. . . and in automobiles too. He was interested in just about everything. He also was a great writer. How many of his books have you read?

One of his books got on the best-seller list back in the early '30s. He wrote *A Genius In The Family*, a book about his father, the chap who invented the Maxim silencer. I read that before I even knew about amateur radio. The book hasn't gotten any the worse for having been written about 60 years ago, so maybe you can find a copy in your library.

One of the big problems an entrepreneur has is in finding a successor. Hiram didn't. He just worked full steam (yes, he smoked) until he suddenly dropped dead. Then all hell broke loose at the ARRL as his staffers fought for power. The eventual winner was "Bud" Budlong W1BUD, who was more ruthless and conniving than the others. In a way it was much like the behind-the-scenes battles in the USSR when dictators died.

Allowed to do just about anything he wanted, and kept in power by directors who were terrified of him, Bud ran amateur radio as his personal fiefdom. He alone made our rules, which were rubber-stamped by the FCC. He made the companies who played ball with him rich and destroyed those that didn't.

Alas, with the entrepreneur gone from the top, what had been a benevolent dictatorship under Maxim became a nasty one under Budlong. He was busier fighting his enemies and protecting his power than in pushing amateur radio to grow.

Like most tyrants, Bud's power corrupted him. He became a hopeless alcoholic and was infamous for his wenching. When I first visited the hams at the ITU in Geneva in 1958, they explained how Budlong had been thrown out of meetings al the previous WARC conference because he was drunk and brought prostitutes into the meetings with him.

This was not news to our State Department, and had a lot to do with their accrediting me as an official delegate at the 1959 ITU WARC. Bud was there too. While I stayed at a small, inexpensive hotel, he had a lavish suite at the most expensive hotel in Geneva. . . paid for by the ARRL, naturally. I don't recall seeing him sober.

Then along came Mort Kahn W2KR, who edged out Harry Dannals for the Hudson Division director's job. Mort found himself among a bunch of directors who, for the most part, knew little about business. They'd worked their way up the League ladder to the most important thing they'd ever do in their entire lives. . .be an ARRL director! Mort, who was a successful businessman, had made his money by selling Tempco, a radio transmitter manufacturing company, to Otis Elevator. He wasted little time in getting the directors to retire Budlong. . .who died shortly after that.

Mort had the strength and the business background to get the ARRL into gear. He was torn between running the League from his spot as Hudson Division director and taking it easy on his yacht. He promoted John Huntoon to General Manager and settled in to run things mostly by telephone.

It all started to come apart for Mort when he got a small group of directors together on his yacht in December 1962. The ARRL had lost membership that year and he wanted to come up with something which would get it moving again. The winning idea came from Tom McCann K2CM, one of Mort's 3999 buddies. The plan was to get the FCC to return to the prewar Class A-Class B licensing system.

This had been screwed up, in their estimation, by George Sterling (W1AE), when he was the FCC Chairman. With Senator Goldwater's support he broke things loose, giving us the Novice and Technician Class licenses. Budlong fought those changes with everything he had, but he was no match for George.

Once the decision was made to propose this rule change, Mort, Tom and the directors had to put the best face they could on it. They decided to call it Incentive Licensing. . .a brilliant political move. They proposed that only the Advanced and Extra Class licensees be permitted to use voice between 160 and 10 meters, as pre-war.

Mort dictated the editorial announcing this move to Huntoon, who published it in the February 1963 *QST*. It sure did get everyone's attention.

When this ill-considered idea bombed, almost killing the ham industry in the next year and a half, Mort moved his yacht to Florida and stopped answering Huntoon's frantic calls.

I found John to be a nice chap. . .he was just totally over his head. He'd functioned well as a gofer for Budlong, but had no business experience and certainly was no entrepreneur.

Today we have David Sumner K1ZZ general managing the League. David

W2NSD/1 flies a C-5B!

is intelligent and dedicated, but he doesn't have the entrepreneurial vision and drive to make his visions happen, which would give him the control he needs over the directors. David is a nice chap and I like him, but he's living in a time when someone like old Hiram is needed to blast the ARRL into the 21st century.

This all came to mind when I got a fax from my friend Joe Sugarman W9IQO . . .you remember JS&A and his BluBlocker glasses ads? Joe's an entrepreneur, a great businessman and a visionary. The ARRL directors need to go out and find someone like Joe to get our hobby back on the tracks and charging into the future.

Chained Again

I enjoy a good scam as much as anyone else. . . so I was amused when a couple of readers sent me copies of a chain letter from the Ivory Coast. They'd never contacted anyone in Ivory Coast, so they wondered. . .

The idea is a good one. It's illegal to send chain letters in the U.S., but there's not much the post office can do about someone in Ivory Coast sending them. This one has four names on the list, each with a ham call. The first is in Hungary, the second in the Philippines and the last two in Ivory Coast.

If everyone follows the instructions and mails $1 to the top name, he'd get $20. The second name, if the chain is unbroken, would get $400. The third would get $8,000 and the fourth would get $160,000. Nice idea. Heck, even if only 1% of the chain pays off, that's a $1,600 payback!

But I suspect this chap has loaded the dice a little heavier in his favor. With the last two names in Ivory Coast, any bets that they're not both him?

So next I checked the calls on the four names. I was not overly surprised to find them bogus. None were in the *Callbook*.

Now, if I were doing this, I'd send out a thousand or so letters, not just 20. I might even go to the trouble of setting up a letter drop in Hungary and the Philippines. . . why waste any of the chain letter booty? With an unbroken chain I'd make $8,420,000. Heck, if 0.1% of the chain works I'd get back $8,420. Let's see, how much is a ticket to Ivory Coast?

That reminds me of another great ham scam a few years back. Hams began getting letters from a clipping service saying that they had an article from a national amateur radio publication which mentioned them. Send $1 for the clipping. Now who could pass that one up? Many sent the buck. . . and got a clipping of their name and address from the *Callbook*. I'm saving that scam for my retirement. That ought to be good for at least $100,000 even today.

Then I'll head for some small country and start chain letters.

How About YOU?

How about *you*? Are you satisfied with yourself? Are you making enough money? Are you doing everything in amateur radio you'd like? Are you fatter than you want? Can't you quit smoking? Is your life under control?

All of these things are within your grasp. You already have everything you need to be successful in life. . . in every way. You only have one more step you have to take. . . a step that is scary. . . a simple step that will change your life forever and bring you those things that you want, but haven't achieved.

The step really is simple. It's also difficult because it means you'll be breaking habits. . . often lifetime habits. We allow habits to control around 99% of what we do, so breaking them isn't easy. But when you think about it, it's habits that are keeping you where you are in life. It's eating habits that make people fat. It's a drug habit that keeps people smoking. It's habit that keeps us from achieving business success. It's habits that louse up our personal relationships.

The alternative to letting habits control our lives is thinking about what we're doing and making a decision based on the results we want. We all have brains, it's just that we're not used to using them. It's easier to repeat the same old reaction. . . habit.

So what's that "little" step you need to take which can start the process of breaking your habits. . . your destructive patterns? You have to make a decision. Yep, instead of doing what you've always done, you have to decide you're going to change.

Since most people are overweight, if you are, how about deciding that you're going to get down to some ideal weight? This is not a decision that next week you're going to start dieting. You want to learn how to break the habits that have been making life difficult for you. So you decide that from this minute on you're going to start losing weight.

This is a great way to start breaking habits because eating is something you do every day, several times a day so breaking your eating habits will keep your mind focused on the change you've decided to make.

There isn't one of you reading this who can't make this decision and make it stick. Yes, I know all about the problems that come with dieting. Your body will fight back. . . for a few days. Your family will in all probability make it miserable for you. Your eating is now going to be very different from theirs.

You've made a decision, so you're going to do it. You're not going to go for diet aids or Dexitrim baloney. You're going to change your eating habits. No more of the things you know are doing the damage. No desserts. No snacks. No more bread. You're going on fruit, vegetables and meat. . . and you're going to cut your calories down so you'll be losing about 1/3 pound a day. . . couple pounds a week.

A drastic diet throws too much of a strain on your body and heart. Just take it easy. . . and stay away from restaurants with their rolls, butter patties and desserts. You're eating to live. . . to live a longer time. . . and a much healthier time. You're eating to look better. This isn't going to hurt you in personal relationships or in business.

And part of your rehabilitation program should include more exercise. No, I'm not suggesting you get out every morning and jog five miles. . . I'm not that heartless. No, a couple of miles will do it. Just joking. . . actually all you have to do is walk a couple miles at a brisk walk. This may require a second big decision. . . but by now perhaps you're ready for it.

Yes, I know all about it. . . no time. Sure. No time to get in a half hour brisk walk in the morning. No time to get up a half hour early and spend a half hour walking and thinking. When's the last time you spent a half hour thinking? That's the nice thing about walking, it doesn't take much concentration.

I know it'll be difficult breaking all those old morning habit patterns. Well, you're just going to make some new habits, just as you're doing with eating. The new habits will keep your body in better shape. . . and the practice in breaking old habits and making new ones is going to stand you in very good stead. Once you get the hang of breaking old patterns it gets easier.

When you've changed your eating and exercise habits, then it's time to start looking at your habits in business and in personal relations. Anything need changing? Are you ready to make a decision to change?

Are you a member of your local ham club? Go to meetings very often? What are your habits with regard to the club? Are you a spark plug who makes things happen? Well, why in hell aren't you? How about making a decision to double your club's attendance? That's a great decision to make. . . and one you can accomplish. The down side is that instead of being a fat old-timer sitting in a back row of the club, you'll probably be made president next year.

Hey, this'll work even if you're an 18-year-old no-code Tech who's been ignoring the hints from the old guard clique running the club that no-coders are dirt. They're going to have a 19-year old president next year and they don't even have a clue. But of course, you have to decide to break your habits.

How're you going to double club meeting attendance? Easy. You get started sending releases to the local papers and radio stations inviting people to come to the meetings. . . with your phone number for further information. You get off short pieces about things like Field Day, a club auction, any special speakers coming, anything a club member has done out of the ordinary.

Write an article about a club member who's active on packet. Another about one who's DXing. Got anyone around who's DXpeditioned anywhere? Anyone on slow-scan? On RTTY? Look for anything unusual to hang an article on. . . and get that phone number in there.

Are meetings a dreadful bore? How about seeing who you can find to give a talk? How far away is your nearest ham dealer? You won't believe the stories he can tell about crazy hams he's had to deal with. Any ham manufacturers within driving distance? Any who might be visiting your area?

Have you any club members who've done anything unusual? Builders? Any gotten articles published? Yes, it takes some habit breaking. You'll have to start writing letters and making calls. But what a breakthrough this will be for you. It'll start opening up whole new areas for you.

If you can't find anyone nearby for a speaker, how about getting some famous hams or major manufacturers to make a short video for the club? I've been known to get out my 8mm video camera and answer questions for clubs. It's a lot easier than flying to Missouri or something.

One of the problems I have when I join clubs is that I seem to get voted to be the president in short order. This is because I *do* things. I bought a Porsche and joined the Porsche Club of America. The next thing I knew I was the president and I had us putting on rallies, gymkhanas and other events.

I joined the Peterborough Chamber of Commerce, became president and tripled meeting attendance in short order. All it takes is a decision to do something.

You've been thinking about trying packet. When are you going to actually make the decision to do it? It doesn't cost much and it's a lot of fun. It's only habit holding you back.

If you use the same decision-making process in business, you'll find it will open all sorts of doors for you. The same enthusiasm you put into your ham club will make your business grow.

If you're a cog in the wheel of a company, start making that cog go faster. Get in earlier. . . work later. Stop wasting time on useless phone calls. Stop wasting time with gossip. Make more business calls. Start letting your bosses know what's going on. Start asking for more responsibility. Break those old habits.

Look for weaknesses in your business and help solve these problems. Find out what your customers think. . . what your suppliers think. What problems are they having with your company? What can you do about them?

Oh yes, if you're worried about the old-timers who are running your local ham club knowing what you're up to, don't worry. They don't read *73*. . . and they probably aren't friends with anyone who does.

All that stands between you and the whole world out there is a decision. Are your habits too strong for you to make that decision? I want to see a slim, healthy you at my booth at Dayton in April. ■

Number 24 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
P.O. Box 2508
Fullerton CA 92633

Doppler Fun in Phoenix

"Over my dead body!" You're sure that's what your "significant other" will say when you suggest drilling an inch-and-a-half-diameter hole in the roof of the family's shiny sedan. You need the hole to install a rotating quad or beam for 2 meter radio direction finding (RDF) contests (often called foxhunts or T-hunts).

Properly done, a hole in the roof will not ruin the resale value. But a big antenna sprouting from a car top is not beautiful to non-hams. It is certainly not a covert way to hunt jammers, either. Furthermore, your wrist and arm get a real workout spinning these antennas against wind load at highway speeds.

After a while, you may long for RDF sets with certain "creature comforts." Wouldn't it be nice if the antenna rotated electronically, with no moving parts? And wouldn't it be great if there were a direct display of the bearing, updated regularly, perhaps even a digital readout in degrees? Of course, no holes would be needed for this ideal system, and it could be quickly installed on and removed from any car.

If you have lots of kilobucks, you can buy Watson-Watt or cavity-backed annular slot antenna RDF sets with all these features and more. Those are what the FCC and other government agencies use.

Your pockets aren't that deep? Fortunately, there is a ham-budget alternative: the Doppler array.

From Trains to Hidden T's

As a car or train approaches you with its horn sounding, its pitch seems to rise. Then there is an apparent abrupt change to a lower tone just as it passes by.

An Austrian physicist named Doppler noticed this phenomenon back in the 1800s (not with cars, of course). He derived a set of formulas predicting the frequency shifts that observers perceive in waves (sound, radio, and light) when the wave source and the observer are moving relative to one another.

Over a century later, H. T. Budenbom figured out how to use Doppler effect formulas to determine the source direction of an incoming radio wave in a matter of milliseconds, using a mechanically rotating antenna. But to be effective on 2 meter FM, the antenna spin rate must be greater than 10,000 RPM! It took the invention of RF diodes and digital integrated circuits to make inexpensive mobile ham-band Doppler RDF sets possible.

Typical Doppler RDF sets for VHF have a ring of four or eight quarter-wave whips on a ground plane. Vertical dipoles are better than whips, but mobile mounting problems make them less common. Switching diodes connect each whip to the receiver, one at a time, in sequence. The receiver thinks it is connected to a single antenna that rotates around an invisible vertical axis in the center of the ring.

This pseudo-rotation causes FM modulation to appear, superimposed on the received FM signal, as a tone at the rotation frequency. The phase of this demodulated tone, relative to the antenna switching sequence, determines the direction of the incoming signal. Bearings are usually displayed on a ring of light-emitting diodes (Photo A).

The Doppler Capitol of T-Hunting

There is no better place to observe ham Dopplers in action than Phoenix, Arizona. "Every T-hunter has a Doppler here," says John Moore NJ7E, a regular at the monthly hunts with his daughter, Beth N7MAT. John has received commendations from the Arizona FCC office for assisting in apprehension of jammers and bootleggers in the ham bands using RDF.

Competitive T-hunting in Phoenix has a long history. In the '70s, Dave Cunningham W7BEP tested out his ideas for soft-switching Doppler antennas there, developing what was to become the Doppler Systems line of com-

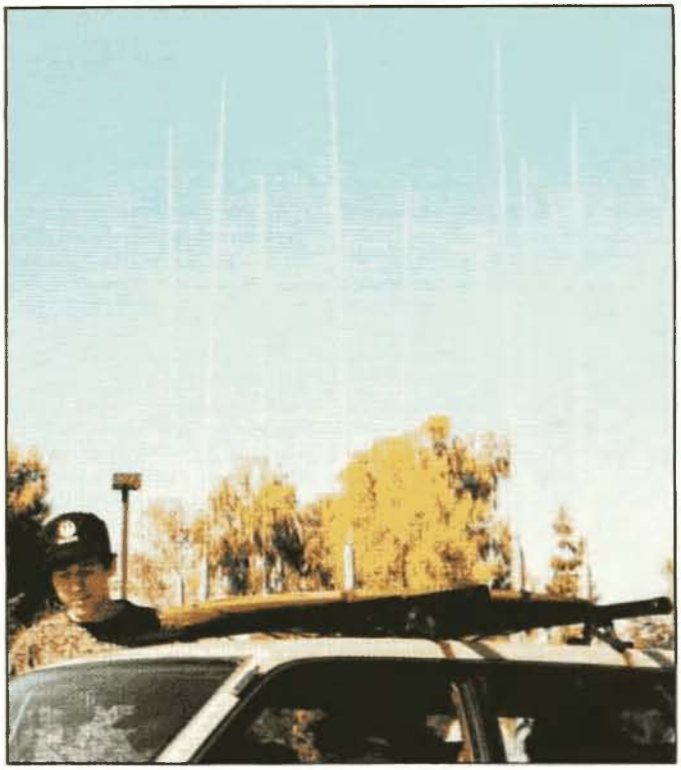


Photo B. A ham radio Explorer post got several Phoenix area teens involved in T-hunting. Eric Jonland N7KDV is captain of this team, which uses an eight-whip Doppler array.

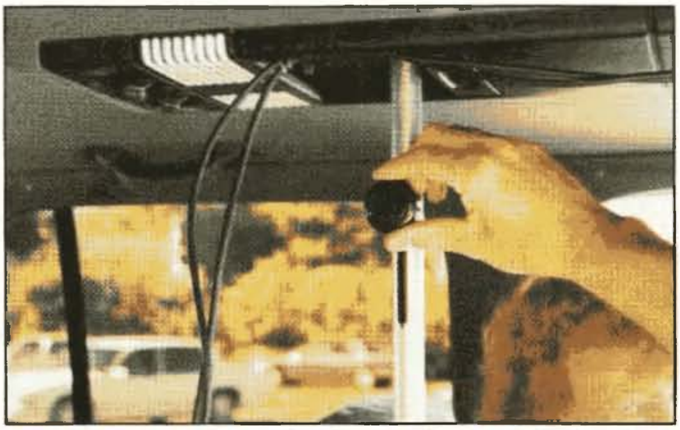


Photo C. It's easy for Bill and Boni Pineups (KC7VV and WT7Z) to change polarization on their yagi from inside by sliding this lever on the mast up and down. These clever hunters have a Doppler on board, too.

Photo A. Doppler RDF sets are "standard equipment" on Phoenix area hunts. Bob and Jackie Neve (WB7SMU and WB7SMT) strap their home-brew readout to the top of the dashboard.

Photo D. For weak signals or on-foot "sniffing," Damon Stewart KB7FUT is ready with his beam and attached hand-held.

mercial RDF sets. W7BEP has not been seen on a hunt for some time, but most hunters still use Doppler technology on the monthly hunt.

Boundaries for this hunt, held on the second Saturday of the month on 146.43 MHz, are a 15-mile radius from the starting point. The hider declares that spot in advance, usually choosing between two large parking lots in different parts of town. Once everyone hears the fox's signal, the hunt is declared to be under way, and the mad dash begins.

To win, you have to be the first to identify the transmitter, so every second counts. Hunters like the instant readout and rapid update rate of Doppler sets for this type of hunt. Home-brew models predominate, usually some variation of the eight-antenna design by Terrence Rogers WA4BVY (see the sidebar).

To aid in tracking weak signals, some put 5/8-wavelength whips in the antenna ring (Photo B). We used both a rotatable beam and a Doppler, as did one other team (Photo C). All the others used only Dopplers for the mobile part of the hunt.

Just like everywhere else, Phoenix T-hunters are super-friendly. I felt right at home hunting with them. Still, even with a top-notch navigator and beam-turner (WA6OPS), I had some trepidations about participating as an out-of-towner in a timed hunt in the dark in totally unfamiliar territory.

You see, these folks start their hunt at 7 p.m., with the idea that they will all find the T in an hour or so and head to a nearby pizza place for dinner. The last thing I wanted was to be the cause of a bunch of starving hams standing around at the end point waiting for us with growling stomachs.

Fortunately, a couple of SWLs arrived at the last minute, looking for a ride along. Since they knew their way around metro Phoenix, I invited one to go with us as an additional navigator. (Aha, someone else to blame!)

Resources for Home-Brew and Commercial Doppler RDF Sets

Complete details of W7BEP's advanced Doppler are in the June 1981 issue of *73 Magazine*. This is a complex project, with about 40 ICs and MOSFET preamps on each antenna. This design is the basis for the Doppler Systems line of commercial RDF units and the switching concept is patent-protected.

Current models from Doppler Systems have improved antenna preamps and new display/interface features. Prices start at about $600, not including antennas. Contact the company for more information: Doppler Systems, Incorporated, P.O. Box 31819, Phoenix AZ 85046; (602) 488-9755.

Construction plans for the eight-antenna WA4BVY Doppler, called the DoppleScAnt, are in the May 1978 issue of *QST*. Contact the ARRL for an update sheet before attempting to build it.

For a complete discussion of the theory of Doppler RDF, read *Transmitter Hunting—Radio Direction Finding Simplified.* This 323-page book by KØOV and WB6UZZ is published by Tab Books and is available from Uncle Wayne's Bookshelf. There is an entire chapter on Doppler techniques, including construction plans for the Roanoke Doppler. The cost of the parts for this 11-IC project is less than $100, including four antennas.

Jim Hoff, our ride-along and a soon-to-be ham, was more help than I could have imagined in avoiding dead ends and low overhangs. We still finished last, of course, but we didn't keep them waiting too long.

Did Anyone Salute?

Be prepared for just about anything on a Phoenix hunt. Hiders love to use modified dual-band rigs as remotes to foil hunters. This time, the T was a dual-band handheld dropped into a fake sprinkler vault, with a dozen feet of leaky coax out on the ground as an antenna. Gee, what polarization is that?

"A while back, a friend of mine hid it in a US flag," NJ7E chuckled. "He stitched two flags together with an HT Inside It—it looked like one flag—and ran it up a flagpole in front of an apartment house down in Mesa.

"There is more emphasis on the sniffing (on-foot hunting for a concealed fox) than on long road chases," John reports (see Photo D). Hiders also like to take advantage of the signal reflections you can get from terrain features. "People do a lot of multipath work, but it isn't long distance. Phoenix has enough mountains that you can play a lot of multipath games. In fact, it's frustrating living in Phoenix because there's no place you can live where you don't have mountains blocking your radio signal."

> ***"Be prepared for just about anything on a Phoenix hunt. Hiders love to use modified dual-band rigs as remotes to foil hunters."***

The Down Side

Easy-to-read displays and rapid response of Dopplers make them a good choice for hunting strong jammers or for short first-finder-wins hunts like those in Phoenix. But in the interest of "full disclosure," I should point out a few disadvantages.

A beam or quad RDF setup has significantly more sensitivity than a Doppler. Some teams use 5/8-wavelength whips on their Dopplers and some designs use "soft switching" to improve signal-to-noise ratio and reduce cross modulation products. But the beam/quad hunters will still get bearings at much greater range. Dopplers are seldom usable at the starting point of long distance weak-signal hunts.

Sensitivity and accuracy of the Doppler method is reduced further if the transmitting station is not vertically polarized. When the hider uses horizontal polarization, multipath reflections are enhanced relative to the direct signal, making homing in much more difficult in urban or mountainous terrain.

The Doppler technique requires a receiver with FM detection, even if the signal is AM (in the aircraft band, for instance). Doppler sets will not track non-carrier modes such as single sideband and pulsed noise signals.

Your Doppler's accuracy will be degraded by proximity to other antennas. The effect is greatest when the other antennas are in front of the Doppler array. NJ7E says his communications whips pull the Doppler indication forward when the signal is toward either side. Rotating a vertical quad or yagi on the same vehicle makes the Doppler indication move 10 to 40 degrees, depending on closeness and mounting location. However, this problem is much less severe when the beam is horizontally polarized. 73

Number 25 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

Deadline for the May classifieds is March 1, 1992.

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ROSS' $$$$ NEW February (ONLY): KENWOOD TS-850S $1,459.90, TM-741A $699.50, VFO-700S $149.90; ICOM 725 $725.00, 2SAT $299.90, 900 $439.99; YAESU FT-703RTT $259.90, FT-709R $289.99, FT-470 $388.00; MFJ 815B $41.90, 941E $89.90, 207 $89.90; HUSTLER RM-40 $19.90, 5BTV $103.90; TEN-TEC 535 $1,129.90, 425 $2599.90. ALL LIMITED TIME OFFER. CALL OR SEND 2 STAMPS FOR USED LIST AND MORE SPECIALS. LOOKING FOR SOMETHING NOT LISTED OR HARD TO FIND, CALL OR WRITE. Over 9000 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB707

EMERGENCY SUPPLIES: Disaster preparedness packs for your shack, auto, office, etc. Free catalog. Slates Products, P.O. Box 4375T, Walnut Creek CA 94596. BNB708

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Continued on page 85

Number 26 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Have you ever wondered why, in a hobby that is based on the art of communication, so little communicating gets done? I'm talking about your average, everyday HF rag-chew QSO. Most of them go something like this:

"CQ, CQ, CQ from W1ABC . . . by for a call."

"W1ABC, this is KØXYZ . . . Kilo Zero X-ray Yankee Zulu."

"K1XY . . . eh, was it Tango? This is Whiskey One Alpha Bravo Charlie. Thanks for the call, old man. The name here is . . . The QTH here is . . . Your signal report is . . . My rig is . . . The weather here is . . . *[Each of these statements is repeated two or three times, then again with phonetics.]* So . . . how copy?" The same exact information is now exchanged from the other side, and then the two parties quickly say, "Thanks for a great QSO . . . hope to hear you on the band again . . . 73."

This is communicating? This activity, repeated over and over again, is why we spend hundreds or thousands of dollars? This is the kind of activity that will attract and hold onto youngsters by the thousands?

Almost all of us would like to have more interesting contacts—to really get to know our fellow hams and make a few friends over the air. The problem lies in the fact that speaking to strangers is not something most people feel comfortable with. Even if you don't have a problem with talking with new people over the air, chances are that the person who has just answered your CQ is terrified.

I'd like to offer a few suggestions on how we can all get over this communication blockage.

Get Off On The Right Foot

The first and most important thing you can do to get a QSO going is to immediately break the monologue cycle. The monologue cycle is present in about 98% of the QSOs I've ever been a part of. You know what I'm talking about—one person speaks for about three minutes, then the other party speaks for about three minutes. Callsigns are exchanged before and after every transmission. This isn't conversation, this is boring.

When I call or answer a CQ, my initial transmission is: "Hi! How are you today? It's a pleasure to meet you. My name is David, and I'm in a little town called Hillsboro, New Hampshire. Over."

That's it. No phonetics. No talk about rigs, signals, antennas or weather. No repeated callsigns. Just a simple introduction, just like meeting someone in any other situation (since amateur radio is a hobby concerned very much with geography, I add the QTH). What happens next is one of two things. Either the party on the other end immediately realizes that he is in a conversation, and an enjoyable discussion begins, or a long silence is heard (he's waiting for the typical exchange of callsigns), followed by a confused but certain entry into the monologue cycle. When this second scenario begins, I give the guy one more try. I ask a quick question, followed by "over." If he launches into another monologue I realize that it's hopeless. On my next transmission I give him all the information he's given me (rig, antenna, weather, etc.), then immediately say good-bye.

Ask Questions

It is a basic rule of conversation that people love to talk about themselves. Oh sure, most are shy at first but, with a little prodding, most people really enjoy talking about their own lives.

To get a conversation going, try asking a question. If you get a short, stumbling answer, ask a follow-up question that forces the other person to go into more detail. Everyone has a story to tell, and if you are the curious type, most everyone's story is truly fascinating. In the last year I've met:

A guy who retired early, sold his house, bought an RV, and spent the next five years traveling around the country.

A guy who worked on NASA's *Apollo*, *Skylab* and shuttle programs.

A guy, operating from a hotel room in Colorado, on tour with the Rolling Stones as a lighting technician.

Talk About What Interests You

The easiest way to make a friend is to find a common interest. When all else fails, we all have an interest in amateur radio to fall back on. Talk about what areas of amateur radio interest you. Are you into packet, moonbounce, ATV or foxhunting? Talk about it.

Of course, the really interesting QSOs start when you can find a common interest other than amateur radio. If I can get past the usual boring monologue with someone, they will usually find that I am interested in aviation (I soloed last month and will probably have my private pilot certificate sometime this spring), music (I used to earn my living as a guitar player/singer—I write songs, too), the outdoors (canoeing, camping), history (the Civil War especially), Stephen King novels (have you read his latest?), woodworking (I have a modest shop in my basement and spend a lot of time making small pieces of wood out of large pieces of wood), skiing (I haven't broken anything yet) and motorcycles (I haven't broken anything yet) . . . and, this is a short list.

You don't know what you have in common with a person until you ask. Finding out what someone does (or did) for a living is a good first step. ("I'm in the publishing business. What do

Continued on page 51

Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

10 and 12m DX Decline

As we go from the winter solstice toward the spring equinox, conditions on the HF bands begin to recover from the winter doldrums. The higher bands, so quiet after dark during the winter months, begin to show signs of life after dark and before dawn.

However, bear in mind that the sunspot cycle is well on its way down, and propagation will become progressively poorer as solar flux values decline. Solar activity will decrease to the lowest point since the mid-1980s, and your DX opportunities on 10 and 12 meters will become fewer as the year progresses.

For February, look for the *best* conditions between the 3rd and 10th, and again between the 19th and 23rd. The *poorest* conditions are expected between the 11th and 14th, and again between the 26th and 29th. Yes, that's right: This is leap year, and February has 29 days!

The full moon will occur on the 18th.

On the best days, there will be *some* DX on 10, 12, and 15 meters during daylight hours, and occasionally around dusk and dawn. You may expect 20 meters and 17 meters to support most of the DX opportunities, and 20 will be open after dark on good days. On the lower HF bands of 30, 40, 80, and 160 meters, you will find lots of DX on the Good (see the calendar and chart) days, but not much on Poor days. Atmospheric noise is still low, and except for an occasional winter storm, it should not bother the weaker signals. Storms often occur on or near the days marked Poor on the chart.

It is now time to dig for the weaker DX signals, as those rock-solid ones of a year or two ago will become less apparent, and often the rare ones will be close to noise levels which, fortunately, will be low. The fellows with yagis and quads will have a definite advantage . . . and even more so, as conditions weaken.

Try for DX across the equator on poorer days, but not over the poles; and, as always, use WWV at 18 minutes after any hour to keep you informed about propagation trends. High solar flux values and low Boulder K and A indexes are the best indicators of DX opportunities on the HF bands. See you in March! 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	15/17
ARGENTINA	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20/40	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
ENGLAND	20	20	20/40	—	—	—	—	15/17	15/17	—	15/17	20
HAWAII	15/17	15/17	20	20	20	20	20	—	—	—	—	10/12
INDIA	20(1)	20(1)	—	20(1)	20(1)	—	—	—	—	—	—	15/17(1)
JAPAN	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
MEXICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
PHILIPPINES	—	—	20	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	15/17	15/17	15/17	15/17	15/17
SOUTH AFRICA	—	40(1)	20	20	20	—	—	15/17	15/17	20	—	—
U.S.S.R.	20	20/40	20/40	—	—	—	—	—	—	15/17	15/17	20
WEST COAST	15/17	15/17	20/40	20/40	40	40	40	—	20	15/17	15/17	15/17

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17	—	—	—	—	20	20	20	—	—	—	15/17
ARGENTINA	15/17	15/17	20	—	—	20(1)	—	—	—	—	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20	—	—	—	15/17	15/17
CANAL ZONE	15/17	20	20	20		20	20	15/17	15/17	15/17	15/17	15/17
ENGLAND	20	20	—	—		20(1)	—	—	—	—	15/17	15/17
HAWAII	—	—	20	20	20/40	—	20	—	15/17	15/17	15/17	15/17
INDIA	15/17(1)	20(1)	—	—	—	20(1)	20(1)	—	—	—	—	15/17(1)
JAPAN	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
MEXICO	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
PHILIPPINES	15/17(1)	—	20(1)	—	—	—	20(1)	20(1)	—	—	—	—
PUERTO RICO	15/17	20	20	20	—	20	20	20	15/17	10/12(1)	10/12	10/12
SOUTH AFRICA	—	—	20/40(1)	20(1)		—	—	15/17(1)	15/17(1)	20(1)	—	—
U.S.S.R.	20	20	20	20	—	20(1)	—	—	15/17(1)	15/17(1)	15/17(1)	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
ARGENTINA	15/17	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12
AUSTRALIA	15/17	15/17	15/17	20	20	20/40	20/40	20	—	—	—	15/17
CANAL ZONE	15/17	15/17	20	20	20	—	—	—	—	10/12	15/17	15/17
ENGLAND	20	20	20	20	—	20	—	15/17	15/17	—	—	20
HAWAII	15/17	15/17	20	20	40	40	20	20	—	15/17	15/17	15/17
INDIA	—	15/17	15/17	—	—	—	20(1)	20	15/17	15/17	—	—
JAPAN	15/17	20	20	20	20	20	—	20	15/17	15/17	15/17	15/17
MEXICO	15/17	15/17	20	20	20	—	—	—	—	10/12	15/17	15/17
PHILIPPINES	—	15/17	15/17	—	—	20	20	20	15/17	—	—	—
PUERTO RICO	15/17	15/17	20	20	20	—	—	—	—	10/12	15/17	15/17
SOUTH AFRICA	—	—	—	20	—	—	—	20	15/17	15/17	—	—
U.S.S.R.	20	20(1)	20	20	—	—	—	—	—	—	—	20
EAST COAST	15/17	15/17	20/40	20/40	40	40	40	—	20	15/17	15/17	15/17

Notes: (1) Possible but rare dual bands (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

FEBRUARY 1992

SUN	MON	TUE	WED	THU	FRI	SAT
						1 P–F
2 F–G	3 G	4 G	5 G	6 G–F	7 F–G	8 G
9 G	10 G–F	11 F–P	12 P	13 P	14 P–F	15 F
16 F	17 F	18 F	19 F–G	20 G	21 G	22 G
23 G–F	24 F	25 F–G	26 G–F	27 F–P	28 P	29 P

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Continued from page 83

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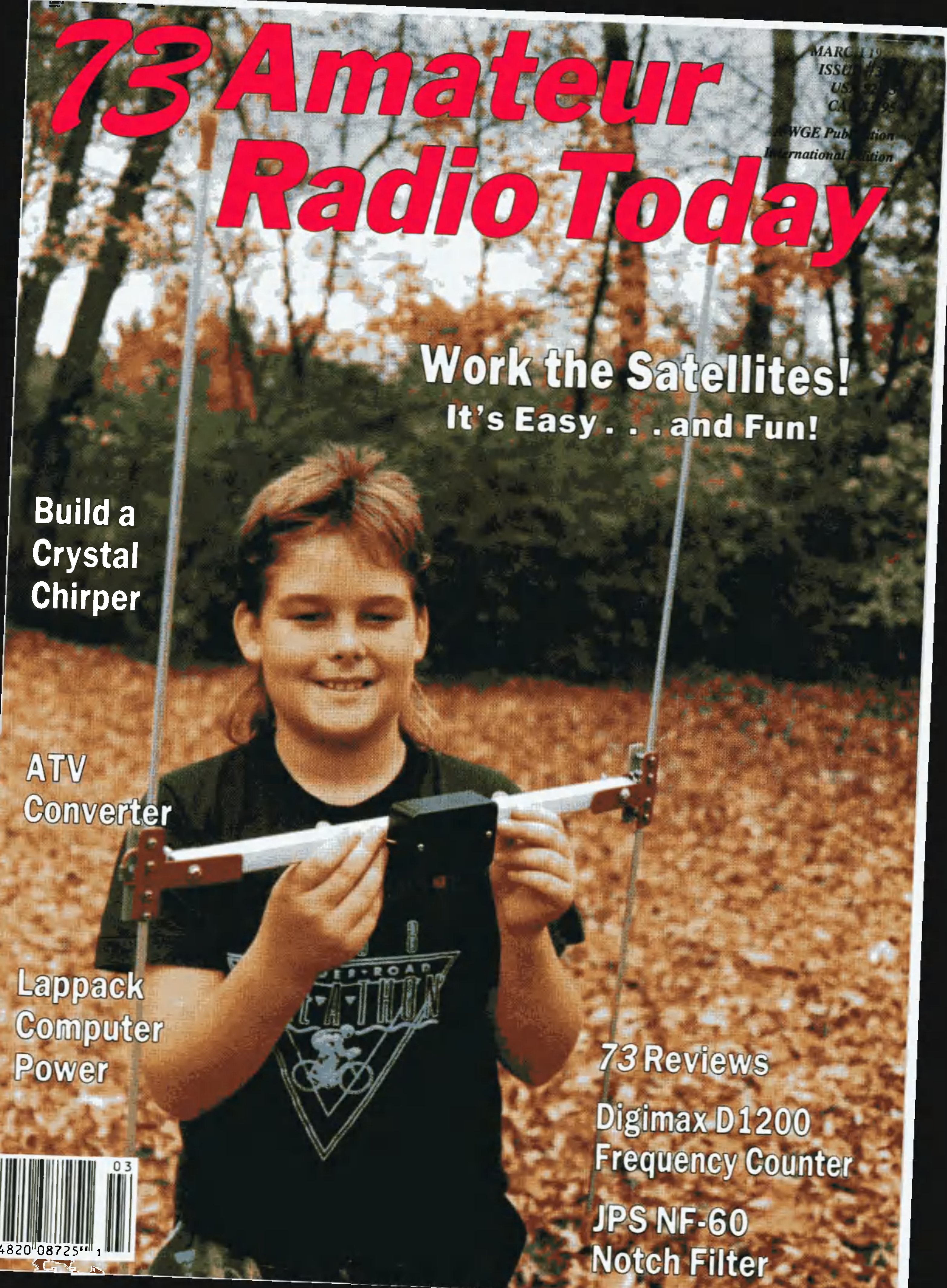

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LETTERS

From the Hamshack

Nestor Noy N2OGC, Union NJ I enjoy your columns a lot and your "Never Say Die" column is numero uno. Recently I've become a codeless Tech, and now I'm working on CW, the outdated requirement, to upgrade. Just because someone had to learn CW "ages ago" doesn't mean we have to learn it today as a requirement. Technology has changed, for better or worse. Perhaps CW could continue for those who enjoy it.

As far as saying that codeless Techs will make a mess of the bands, that is not true. The bands are a mess now. There is talk on how the ham bands will become like the CB band, but I doubt it. Perhaps some of you should monitor the CB frequencies and listen to the professional way in which a lot of CBers conduct themselves on the air.

Instead of bickering and blaming people, let's start to use some manners like the hams we are, and welcome newcomers to the bands. How about using your knowledge and experience to help newcomers set up their stations, and build or repair equipment? But please do not take your knowledge only to your grave.

Dave Gerrard VE3VID, Eganville, Ontario Read your editorial "Never Say Die" a few months back about falling asleep at will. On trying your technique I repeatedly found that I'd fall asleep in the middle of the whole thing. Do I still owe you a subscription? Hi, hi.

I get a kick out of the way you bash the standard issue rhetoric still upheld by the moldering old guard of CW—and all the slogans and banners they still wave in honor of its preservation.

I am a relatively new licensee, but not new to the hobby, having several licensed family members. Two days ago I upgraded to the 12 wpm level with the assistance of the 12 wpm code tape from your "bookshelf." I practiced with the 6+ wpm tape until I felt I could easily master our 5 wpm exam, but upon sitting for the exam, I found that the text sounded too slow and thumping.

The examiner then sent me the 12 wpm drill, just for fun, and that's when suddenly the chickens came home to roost. Five minutes of CW copying never were so smooth.

All I know is that the 6+ tape must have easily been 12 wpm with characters sent at 15. Hmmmm. . . was this some kind of well-planned deception, or just an accident?

Who cares? I intend to pass on my practice tapes to some other poor, unsuspecting no-coder and see how he likes getting his 12 wpm endorsement when he sits down to do the fiver.

Dave, the characters on my tape are sent at 13 wpm, but are spaced to bring the net speed down to 6 wpm. The whole idea is to make it so you only have to learn the sound of each character once. That's why this system is so easy compared to the others.—Wayne

Kennon A. Smith W4TKI I just finished reading your December issue of *73* from cover to cover, and congratulate you on a job well done. I always read your editorial with some ambivalence; I find it both angering and stimulating. I don't agree with it all, but you cover areas where I believe hams should be stirred up. So keep up the good work. I applaud most things that encourage free thinking against an entrenched bureaucracy.

I think your construction articles are good, but I would like to see more inexpensive projects. Your two articles on the Ramsey kits were the kind I like to see.

I also like the thoughts on DXpeditions. They are very fine, but so far due to my finances I have had to enjoy them vicariously. I really get a thrill out of working DX, but I enjoy it more when I get a chance to know the fellow on the other end of the line.

One thing I don't approve of is your putting down us older folks. Older folks can have imagination, and it doesn't take old age to make a person vegetate. Why I said this is because I am over 50 and it kind of hits home.

Ken, sure a few of us old fogies do things, but most of us need a good kick in the slats to get us off the couch. At 69 I'm scuba diving, skiing, piloting a 747, at the helm of a nuclear hunter-killer submarine (SSN-677) under the Pacific, and raising holy hell with my state government, and just finished my new recording studio. At "over 50," you are too short of money to make a one-week DXpedition to the Caribbean! Jeesh. Meanwhile put together some kits and write 'em up for us. —Wayne

Mark F. O'Brien N8PQJ, Ann Arbor MI I am one of the new "no-code" Techs, and I have enjoyed reading *73*. What prompted me to become a ham? It was my initial interest in putting radio telemetry and amateur TV payloads on "model" rockets. When the codeless Tech license became available, I decided it was time to give amateur radio a try. It really wasn't that difficult studying for the test, and during the eight weeks I waited for my license, I learned an awful lot about the hobby (and there is still so much to learn). I'm active on 2 meters, and enjoy packet radio. I have also been building some small 2 meter transmitters from plans that appeared in recent issues of *73*. These will become rocket payloads sometime in 1992.

I have talked to many codeless Techs, and there is a lot of interest in 6 meters, but little equipment is available. Perhaps there are some manufacturers, such as Ramsey Electronics, that would market a 6 meter transceiver if they knew there was a lot of interest, or maybe there are some talented hams out there who can submit a plan to *73!*

Jeffrey L. Wheat N6ZYX, Norton AFB CA I have been trying some new things in ham radio, some inspired by something you wrote over the past year or so. I have been teaching a Novice and no-code Tech class for any age group (kids are very open-minded, as well as fun to teach), but yesterday I got to give a Novice exam to a Handi-Ham. A friend of mine, Mark KJ6H, asked me if I would mind helping him with the exam for Jerry. I got a kick out of being able to sign that 610, even more than any time I passed an upgrade.

John Roessler KB6WB, El Cajon CA I generally do not write letters to magazines, and am considered a member of the quiet majority. But I must put my two-cents' worth in on a subject that I have noticed a lot of complaining about lately.

That is "Codeless Techs" complaining about brushoffs, etc., on the air. I don't know how it is in other parts of the country, but I know in this area I personally haven't noticed any bias or prejudicial remarks over the air concerning "Codeless Techs." In fact, one doesn't know if a person is codeless or not unless the person so states.

Our club, the Amateur Radio Club of El Cajon, has approximately 325 members, and all classes of amateur radio operators as well as nonlicensed people who are interested in amateur radio. In fact, when a licensed operator joins our club, he/she is issued a WAMO number. This means "Worked All Members Once." We have a net every Wednesday and Saturday evening in which club members meet on the air and exchange WAMO numbers.

Our ARES division here in El Cajon boasts members of all classes. At the various functions we have worked in complete harmony. Our club holds classes for all phases of the license requirements for anyone who wishes to obtain a license or upgrade. I am a member of the SANDARC VEC, and when an individual passes an examination, he/she is congratulated when handed the CSCE. Not all of us "ole fogies" are sitting on our duffs complaining about "codeless Techs."

Sounds like the Amateur Radio Club of El Cajon is one of the good ones. Keep up the good work. Unfortunately, yours is not a common experience. I have heard nasty remarks about Technician class hams on HF, and on dozens of repeaters all across the country. I've even seen negative messages on packet. We get letters every day from new Techs, telling us about how the local hams have treated them badly. Your WAMO net is a great idea. Why don't you write up an article about how your club is welcoming newcomers. Take a few photos and send it in to Radio Fun. *Other clubs would do well to follow your example.*

—David N1GPH.

Randy Van Voorhis KD4DWF, Bartlett TN I'm writing regarding your editorial in November. I have the entrepreneural "bug" that you speak so much about. I would be interested in finding out more about how to give the two ARCs I am a member of a kick in the butt. They both have good intentions, but working independently of each other, they are unable to get as much done as they could in a joint venture.

The Delta ARC and the Mid-South Amateur Radio Association, W4BS and W4EM, respectively are both thriving clubs, with the Delta ARC just passing 350 in membership. All of the "old fogies" roll into the meetings, say hello to one another, and leave, not even introducing themselves to the MANY new hams trying to be accepted into their group. If some of these folks would smile and offer their knowledge as an elmer, the Memphis area would be unstoppable. As you touched on in the November issue, PR is desperately needed at the local level. In *QST*, I read where a long process to hire a PR person and a PR firm are finally over, but each club needs to promote as much as possible. If I had not known Lane O'Daniel WB4DNX for 15 years, "hamming" would not even be known to me. I have only had my license since August '91, and didn't realize how hard it would be to motivate a group of people who are supposed to be "enjoying" their hobby. If it were not for a *few* ambitious members, the clubs would probably all but die out.

I have my no-code Tech, but my goal is amateur Extra by the end of 1992. I am a big fan of yours even though I have only been introduced to you through *73* in the past several months. If I can manage to get the people that went through the Delta ARC licensing class with me together, I will get a picture to you. We have had a very large response to the no-code license here in the Memphis area, and are having regular classes.

Yes, I know there is only one *73*.

James D. Toews VE7EMP, Prince George B.C. I just received my December *73* in the mail today, and as usual I read your editorial first, and then the "Letters" column, which is (as it normally is) full of letters patting you on the back. I have never before written an editor of a magazine, but I felt compelled to write you because, well, you're right! We all have to do something to help the hobby and the new hams getting into it. In Canada we have had a no-code license class for a year now which has doubled the amount of active hams in Prince George on the 2 meter band. These new hams are, in my opinion, as good in amateur operation as anyone else in town. They are courteous, eager to learn code eventually, and most important of all, ACTIVE! I am a fairly new ham myself. I have been licensed three years, upgrading to Advanced class two years ago, so I can still remember how a newcomer feels coming on the scene and not getting a 100% welcome feeling from the old-timers.

One thing a new ham has to realize is that there are some people out there who will never make you feel welcome, no matter how hard you try. Take Wayne's advise and forget them. Get a bunch together and form your own club; that way you will find you can get things done and not have to pack along any dead weight.

Prime repeater mountaintop land became available a while back, and the existing ham club couldn't see what a resource this was. Five of us met and decided to form the Prince George Radio Experimental Society. We applied to the government, were granted the land, and we established an HF radio contest station (VE7EPG) and a repeater site (VE7RES) which is linked all the way north to Fort Nelson, 518 miles north of Prince George, making it one of the longest ground-linked systems in the province. Our group has done a high altitude balloon launch which reached 100,000 feet, and was heard over 450 miles away. We are now at 12 members in less than a year, and looking at establishing an ATV repeater at our mountain site. This was all done by hams licensed three years or less. So next time you are at your club's general meeting, and your ideas are harped at by the "old-timers," form your own club and get something done.

THE TEAM

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73 Amateur Radio Today

MARCH 1992
Issue #378

TABLE OF CONTENTS

FEATURES

REVIEWS

DEPARTMENTS

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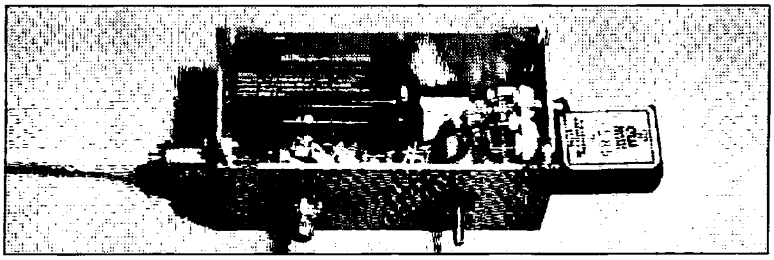
Cover: Jason Pelaez N8NDQ with his DF antenna. See "Homing In" on page 70. Cover photo by Dave Pelaez AH2AR.



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NEVER SAY DIE

Wayne Green W2NSD/1

The Worrywart At Dayton

With Dayton looming a few weeks away, it's almost time for me to start thinking about my talk. Of course I say this to myself every year and I follow the same pattern each time—I put off thinking about it. Then, suddenly I'm addressing a roomful.

I'm reminded of a Japanese pianist friend who is so good that he doesn't have to practice much to get by. The result is that he gets by at concerts, but when it came time for him to make a recording where he had to be perfect, not just darned good, he was in trouble.

Having done just about everything there is in amateur radio; having DXed from dozens of countries; and having been writing editorials for 40 years now, I don't have any problem getting up in front of an audience and talking at length. But like my Japanese friend, I've been taking the easy way out and not planning my talks before I get started.

What should I talk about at Dayton this year? No-code? Old-timers? Our mess on 20m? Ham broadcasting? WARC? Digital voice? The loss of our consumer electronics industry to Japan? The pathetic vapidness of our QSOs? Our thousands of virtually unused repeaters? Fixing our American educational system? There isn't anything much I can talk about that I haven't written about in my editorials, so I don't know.

With technology rapidly leaving us far behind, I wonder if you have any ideas on how amateur radio can even pretend to be worth continuing as a hobby which might be worth airing at Dayton? As I write this I'm just back from the Winter Consumer Electronic Show in Las Vegas. There I heard about the latest in DSP, CDI, DCC, DAR, MD and other technologies of the '90s. As I looked over the new equipment and attended lectures, I wondered how many hams in my Dayton audience would be able to identify these new technologies by their letters? And how many could explain them at a ham club meeting?

The world is going into desktop publishing, home video production systems, pocket cellular phones which plug into your car, arcade quality games at home, notebook computers, and pocket faxes, while we're fighting over the Morse code. . . which to me is like arguing about deck chairs as the Titanic sinks.

Microelectronics has made it impossible for us to build anything but the most simple equipment. It's time to stop fussing about that. So what role is there for amateur radio in the next century?

The original justifications for our hobby have been made irrelevant as technology has swept past us. I suggest we either come up with some new and compelling reasons for our use of billions of dollars in public property or else contemplate eviction.

We were at one time supposed to provide a source of technically trained people in case of a wartime need. We're no longer able to even remotely cope with today's technology, so that's out. Worse, today's military "technicians" are being taught to replace boards by the numbers, not to fix them.

We're supposed to be able to provide emergency communications. We still do this to some degree, but cellular telephones and other more modern communications technologies are fast making us redundant. There's no comparison between high-speed digital communication technologies and our slow, error-prone CW traffic networks which the League is still promoting.

We're also supposed to be providing international good will. We still do, a little. But our demand for contacts and QSLs from rare countries has killed that benefit. We'll be hearing about that at WARC, you may be sure. Amateur radio is perceived to be no more than a hobby for rich Americans and Japanese by many third world governments.

At Dayton this year, can you come prepared to explain briefly what benefits you think we have to offer America. . . and third world countries? What justifications have you for our continuing to use our priceless frequencies?

I'll have to put a time limit on contributions as a way to keep some of the long-winded 75m geezers from pontificating at length. I'd like to hear from hams who have good ideas and can express them.

Instead of my giving a talk this year at Dayton, how about a workshop where we discuss what benefits we can offer in exchange for the value we're getting?

Think of our hobby as a product. It has to be good to attract buyers (newcomers). It has to keep up with the times. It has to provide benefits to the country in exchange for its franchise for exclusive use of public property (our frequencies). It also has to be promoted and advertised if it's going to attract customers. And we have to have some sort of customer service to keep the customers happy (presumably the ARRL).

We're weak in every aspect of our marketing. We do little to promote the product. We do even less to advertise it. Customer service? Har-de-har! We've been paying the bill to our supplier (the government) with IOUs.

We have what could be a fantastic product. We could even pay for it with services. I'll be interested at Dayton to see if you come to my talk and just sit there. . . or if you come with ideas on ways we can pay the freight. . . with ideas on how we can better promote and sell the product.

I have plenty of ideas. . . some of which I've outlined in my editorials. . . but I have no monopoly in this field, so let's hear yours. I've got up to 90 minutes allotted. . . time for a good 50 ideas to be proposed.

The Old Days

The days when hams could build their own equipment are long gone. Most of today's electronic circuits are just too complicated for the kitchen table. Sure, it's fun to put together kits. . . and I encourage it. . . but with almost all parts being made in Asia and few parts sellers left in the U.S., our days of building state-of-the-art receivers and transmitters are long gone.

The day when the military might suddenly be in need of radio operators is history. That meant something when the military communications used Morse code and they didn't want to have to take months to train operators. Even the best of our technical training is no longer of value to the military. Our experience has little relevance when it comes to operating or repairing military electronic equipment.

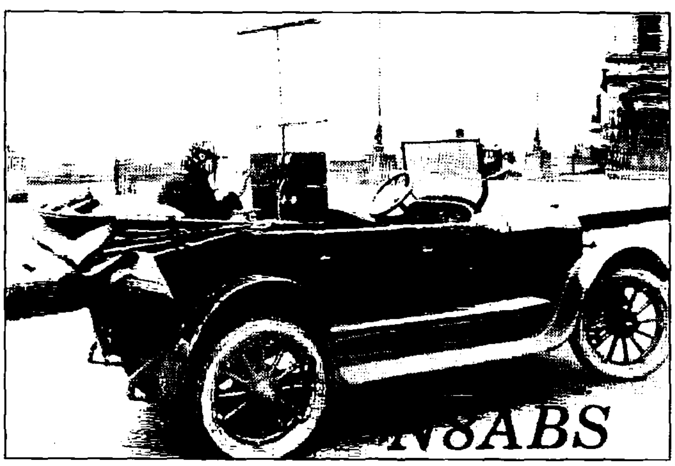
The military also supported us in days of yore as a way to reserve a body of frequencies they could commandeer in time of war. They don't need those any more either.

All of which leaves us with a sack of nuts.

One benefit we might be able to provide would be a growing pool of young electronic enthusiasts who would go on to become technicians, engineers and scientists. We know that America is either going to somehow develop high-tech career people or else we're going to continue to lose the world economic battle.

But we're going to have one hell of an uphill battle. We have our whole educational system and its unions to fight. We even have a large percentage of our own hams fighting to keep youngsters out.

If you think I'm wrong in any detail, please put your word processor (even if it's a pencil) where your mouth is and let me know how you think I'm off base.



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

The Next SAREX Mission

Four ham astronauts will fly in the upcoming STS-45 shuttle mission. Pilot Brian Duffy N5WQW, mission specialist Kathy Sullivan (call pending), mission specialist Dave Leestma N5WQC and payload specialist Dirk Frimout ON1AFD plan to operate on 2m FM during the eight-day flight.

Currently scheduled for liftoff on March 14 at 1313 UTC (an alternate date of March 22 at 1301 UTC is possible), this mission will fly in a high inclination orbit (57°) which should provide radio coverage over a good deal of the Earth. The seven crew members will be divided into two teams on different sleep schedules which will result in 24-hour activity. Since there are ham astronauts on both teams, there will be plenty of opportunity for two-way contacts.

A number of pre-arranged school contacts will be established as part of the mission profile. In addition, there is a good chance that quite a few free-for-all contacts will be made, particularly during each team's pre- and post-sleep times. Since system power is limited during this flight, the shuttle's 2m Motorola HT will be powered by battery packs (a total of 12 will be carried along). All contacts will be on 2m FM voice. There is a good chance you will hear the shuttle transmissions on 145.55 MHz during most passes in your range. Transmit up to the shuttle on one of the following frequencies: 144.91, 144.95 and 144.97 MHz. *TNX to Lou McFadin W5DID at NASA JSC.*

Kenwood K.I.D.S.

Kenwood has come up with an exciting program called Kenwood K.I.D.S. to help young people discover the fun of amateur radio. Kenwood asks amateur radio clubs to co-sponsor a local school, scout troop, or youth group with the Kenwood K.I.D.S. program.

Sponsoring clubs provide elmering while Kenwood provides the educational materials and prizes. For every 10 new hams sponsored, a club receives 10 $25 gift certificates from Kenwood.

All clubs sponsoring at least one group of 10 Kenwood Kids by March 1, 1992, will be entered in a drawing for Kenwood's TS-950SD top of the line transceiver. Each of the youth clubs with 10 or more new members will have a chance to win one of 10 complete stations consisting of a TS-140S transceiver, PS-430 power supply, AT-250 antenna tuner, and MC-60A microphone.

Write Kenwood for a Kenwood K.I.D.S. package containing 10 copies of *Now You're Talking,* the instructor's manual, a certificate for one copy of Ham Windows, and the Kenwood K.I.D.S.'s program outline and promotional materials, including forms to claim gift certificates. Kenwood U.S.A. Corporation, Kenwood K.I.D.S. Program, P.O. Box 22745, Long Beach CA 90801-5745. *TNX Mike Forsythe of Kenwood.*

DARA Scholarships

Eight scholarships in the amount of $2,000 each will be awarded this year by the Dayton Scholarship Program to deserving students graduating from high school. The awards will be based on financial need, scholastic achievement, and involvement with the amateur radio community. There are no restrictions on the course of study, nor must the student be planning on a four-year baccalaureate degree. However, schools or technical institutes awarding associate degrees must be accredited.

Three forms must be submitted no later than May 15, 1992: one by the student, one by the student's principal or guidance counselor, and one by a licensed member of the local radio club. If there is no local club, any licensed amateur radio operator may fill out the form.

The student's application must be submitted with: 1. A copy of the student's amateur radio license; 2. A transcript of the student's high school grades; 3. A copy of the letter of acceptance from the school the student will be attending; 4. A 75-word or less typed composition explaining the student's future plans, and why the scholarship is important. The student should be specific about how the scholarship will directly affect the applicant and the applicant's family.

Winners will be notified by telephone around June 1, 1992. For application forms, write DARA Scholarship Committee, 45 Cinnamon Court, Springboro OH 45066.

New ARRL Director Elected

George S. Wilson W4OYI, an attorney from Owensboro, Kentucky, was elected President of the Board of Directors of the ARRL on January 17.

Mr. Wilson succeeds Dr. Larry E. Price W4RA, of Statesboro, Georgia, who has been President of the League since 1984. Dr. Price will continue to serve as International Vice President of the League.

Mr. Wilson, who has been an active ham since the age of 16, was first elected Vice Director to the ARRL Board from the Great Lakes Division in 1982. He has served on numerous board committees, and has long been involved in the League's emergency and public service communications activities. In addition, he served as an advisor on disaster communication to the Kentucky State government.

New Source of 70cm QRM

National Oceanic and Atmospheric Administration stations are being required to relocate their wind profiler radars from 404.370 MHz to 449.000 MHz. Although most RF is directed vertically within 17 degrees, the main carrier's high mode will be approaching an ERP of 22 megawatts, and the 30 to 60 dB of residual RF may not be enough to preclude interference to those within 5 MHz of operation. UHF FM repeater operations in the area of NOAA stations are likely to experience some degradation.

This frequency move is being directed by the National Telecommunications and Information Administration (NTIA) and Interdepartmental Radio Advisory Committee (IRAC). The move is based on concerns about the rare instances of interference to the safety-of-life SARSAT/COSPAS satellite uplink systems on 406–408 MHz. Although NOAA systems inhibit operation during an overhead pass, other entities, such as universities, may not be as diligent.

Whit Brown WB0CJX writes: "Surely, there must be a better alternative to this move, which has been kept unusually quiet. It would seem that a minimal move downward in frequency could eliminate the infrequent satellite problem and cost the taxpayers a lot less than a banzai migration of 45 MHz, altering the operational characteristics of thousands of existing amateur repeaters and perhaps compromising the performance of other commercial services." NTIA's concern for safety-of-life issues is, of course, valid; but so are the safety-of-life services provided by the amateurs now sharing this spectrum, and public safety services from 453–454 MHz. Other services within the 10 MHz envelope include fire, broadcast auxiliary, industrial, land transportation, relay press, taxi, petroleum products, local governments, power and water, and mobile telephone. *TNX Whit Brown WB0CJX, Mid-America Coordination Council, Inc.*

TNX...

...to all our contributors! You can reach us by phone at (603) 525-4201, or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 525-4438 (300–2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun.* You can also send news items by FAX at (603) 525-4423.

Build a GaAsFET Preamp Sequencer

Mast-mount your preamp for maximum performance.

by Ron Klimas WZ1V (ex-WA1VRH)

Thinking about mast-mounting a receiver preamp for your VHF/UHF station? Build this digital sequencer for uncurtailed SSB or semi-break-in CW operating!

If your VHF/UHF station has a few dB of feedline loss, and you use a transceiver, mast-mounting a GaAsFET preamp offers significant receive improvement. You can mount the preamp in-line with the main feedline using a pair of SPDT coaxial relays for isolation during transmit. The big problem is to keep that transmitter RF out of your preamp. Avoiding the pitfalls of a blown device will require adequate relay isolation, transient suppression, and timing control of your transceiver, linear amplifier, and relays.

Circuit Information

The sequencer circuit is shown in Figure 1. A 7805 on-board regulator allows operation from a single 12-volt supply, and provides RFI immunity. Key elements of the sequencer are an RS flip-flop, U2 pins 8–13, used to guarantee continuity of preamp bypass at the beginning of a transmit sequence; and a nominal 110 millisecond delay generated by integrator (R1 + R2) * C1 feeding into Schmitt-trigger U4. This gate has a volt of hysteresis with a positive threshold of 2.8V, and a negative threshold of 1.8V. This guarantees that the output cannot change state until C1's charge changes by at least a volt, thus ensuring a fixed minimum delay under worst-case input conditions. More on this subject later. Bypass switch S1 is provided to manually disengage the preamp. Mode switch S2 routes the keying to either PTT or CW input.

When a ground closure from either the mike PTT or CW key is applied, U3 pin 6 goes high. This sets the RS flip-flop Q output at U2 pin 10 and disengages the preamp. C1 charges toward the positive threshold of Schmitt-trigger gate U4 pin 1.

After a 110 ms delay from (R2 + R1) * C1, U4 pins 4 and 10 go high. This enables AND gate U1 to key the transmitter. The preamp is held disengaged via U2 pin 3 high, and the flip-flop is reset for the next cycle.

Most transceivers go into a non-defeatable

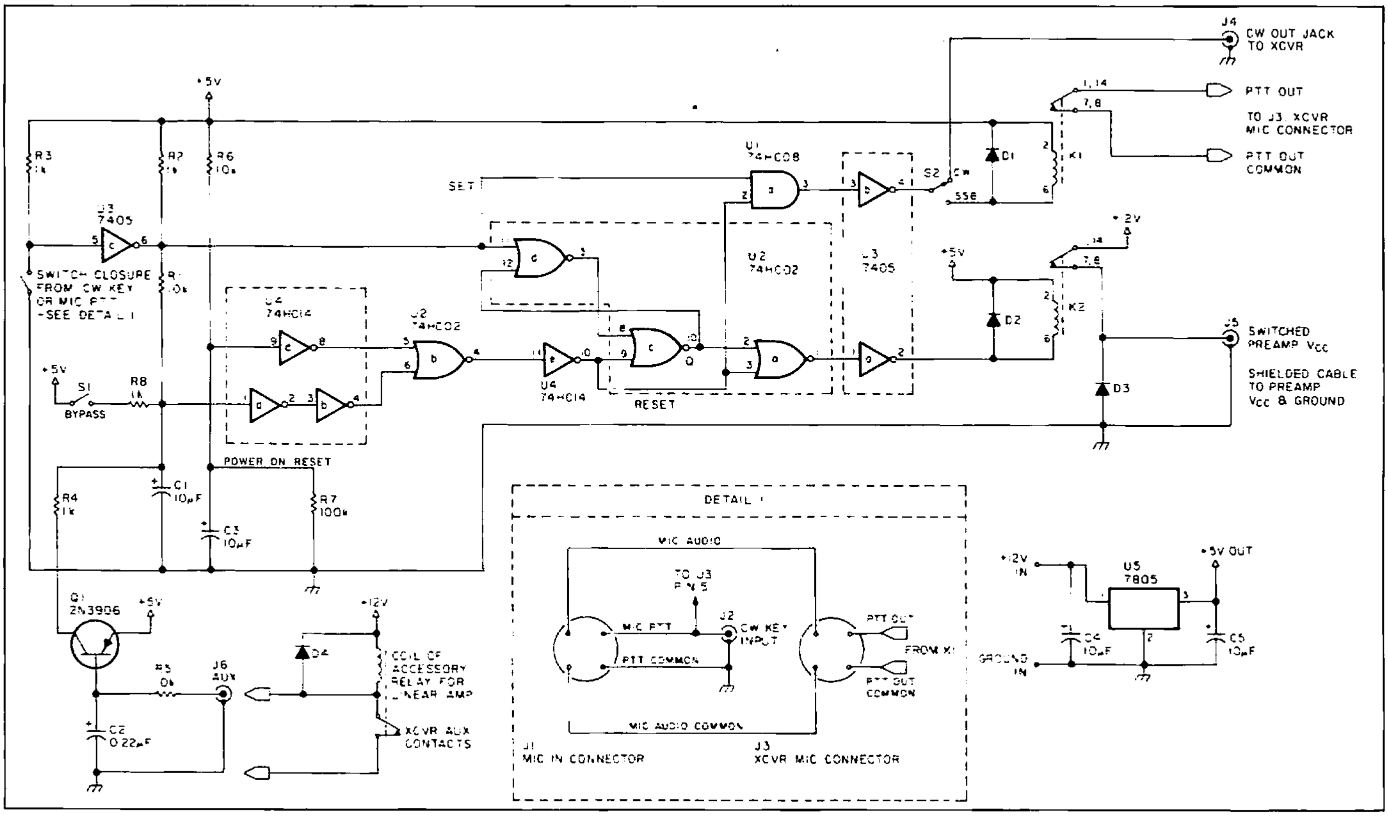


Figure 1. Schematic for the GaAsFET preamp sequencer.

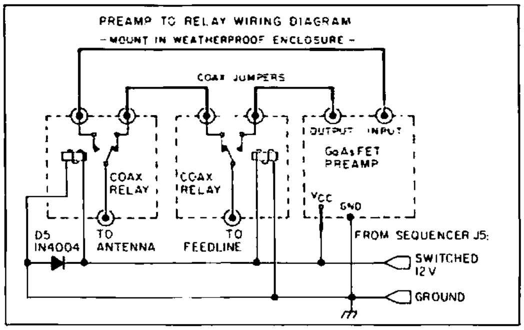


Figure 2. Mast-mounted preamp-to-relay wiring diagram.

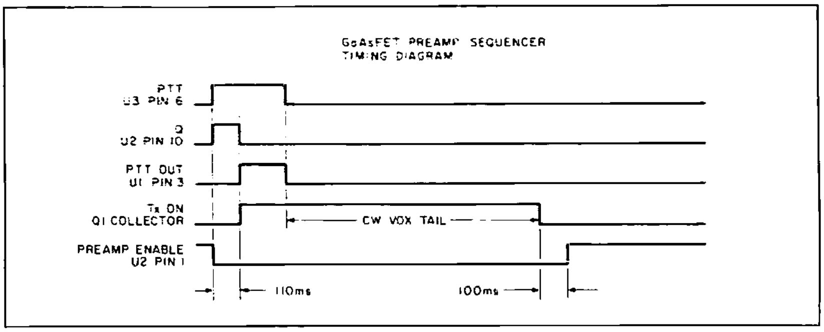


Figure 3. Sequencer timing diagram.

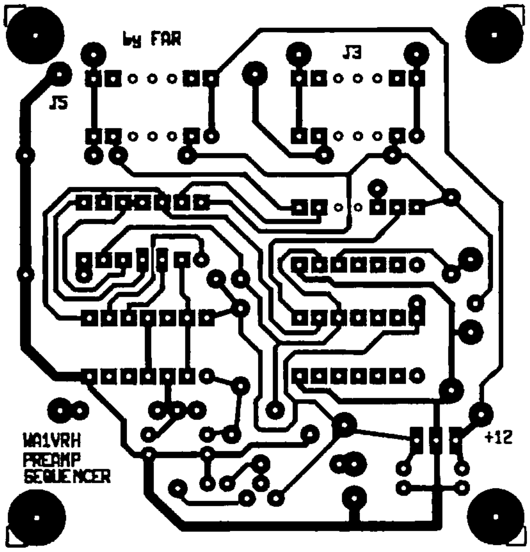


Figure 4. PC board foil pattern.

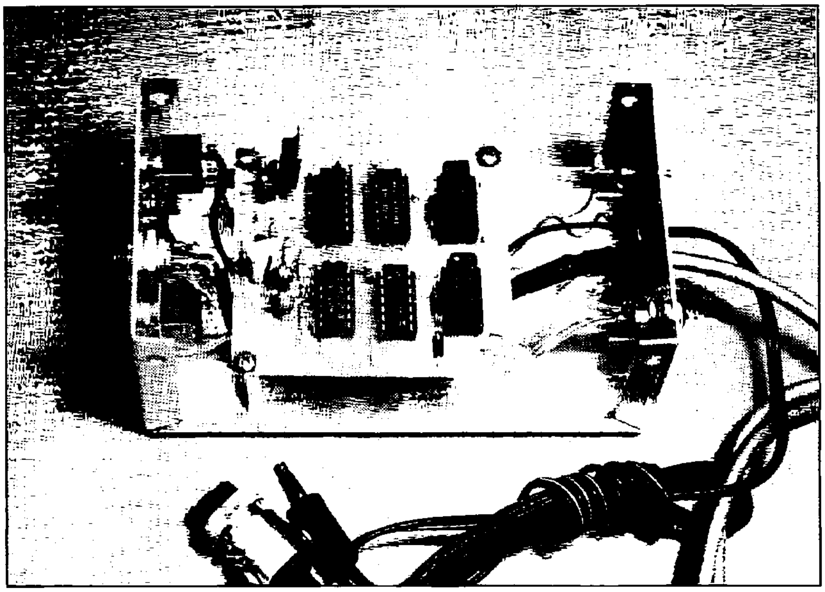


Photo. Inside view of the completed preamp sequencer.

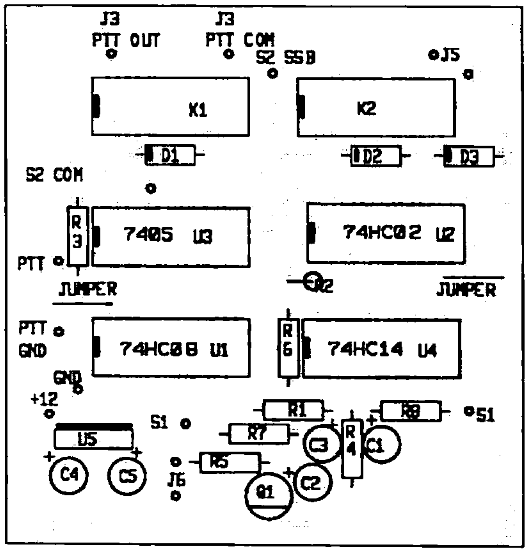


Figure 5. PC board parts placement.

GaAsFET Preamp Sequencer

Part	Description
U1	74HC08 AND IC
U2	74HC02 NOR IC
U3	7405 open collector inverter IC
U4	74HC14 Schmitt inverter IC
U5	7805 +5VDC regulator
Q1	2N3906 PNP transistor
C1,3,4,5	10 µF, 25V tantalum, 20% or better
C2	0.22 µF, 25V tantalum, 20% or better
R2,3,4,8	1.0k, 0.25W, 5%
R1,5,6	10k, 0.25W, 5%
R7	100k, 0.25W, 5%
D1,2,3,4,5	1N4004 rectifier or equivalent
J1,3	mike chassis connector
J2,4,5,6	mini-phone jack open circuit
K1,2	5V coil SPST DIP relay
	Mouser P/N 433-D31A310 or equivalent
S1,2	SPDT mini toggle switch
CC1,2	16-pin component carrier adapter plug

All parts are available through Mouser Electronics, P.O. 699, Mansfield TX 76063; (800) 346-6873. A blank PC board is available for $4 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

VOX mode during CW semi-break-in operation. This is a fast attack, slow decay VOX that holds the transmit mode on between CW characters while you send, preventing relay chatter. Unfortunately, residual RF is usually present at the output during this apparently idle mode. A linear amplifier would most surely bring this up to a level that could be potentially damaging to a preamp engaged in the line. The decay time of this "VOX tail" also varies from rig to rig. Therefore, the sequencer must be able to sense this condition and keep the preamp disengaged. This is done by interfacing the transceiver's AUX contacts, used to hard-key a linear amp, into the sequencer via Q1. The fixed minimum worst case time for the Schmitt trigger to change state is 44 ms. This is derived from the following capacitance discharge equation:

$$V_{C1} = E_{MAX} \bullet e^{-t/RC}$$
$$1.8 = 2.8 \bullet e^{-t/10k} \bullet 10\,\mu F$$
$$0.643 = e^{-t/100ms}$$
$$\ln(0.643) = -0.442$$
$$0.442 = t/100ms$$
$$t = 44.2\ ms$$

The time constant (R5 × C2) for Q1 to conduct after the AUX contacts close is only 2.2 ms, however. Therefore, Q1 will recharge C1 long before a state change could occur. The integrator R1 × C1 is forced to guarantee a full discharge cycle of 100 ms, maintaining absolute protection of your preamp at all times. None of the commercial or published designs I've seen yet will guarantee this level of timing integrity on both the make and break sides of the cycle under every type of input condition. A popular design, using comparators with inadequate hysteresis

and no latching/feedback techniques, may work fine on SSB, but invites disaster on CW. Figure 3, the timing diagram, summarizes this system's operation.

A power-on-reset is provided to reset the flip-flop to a known state on power-up. 1N4004 diodes are placed across all relay coils for transient suppression.

Construction

If you don't want to use the PC board patterns, you can construct the circuit on a 0.100-inch grid phenolic prototype board using wire-wrap sockets and component carrier adapter plugs for passive components. Use short connections between C4, C5, and U5, however. The 1N4004 diodes connections across each relay coil should also be kept short. (Don't forget to solder one across your accessory relay coil).

> ***"It is advisable to test your circuit before wiring in your preamp head/coax relays."***

If you have two or more items to key on transmit (such as a transverter and a linear amplifier), you will need an accessory relay with as many pairs of contacts as you have items. If you use your AUX contacts to directly key your only accessory, install a 2.2k resistor between the J6 tip and +12V. If your transceiver outputs a positive voltage on transmit, feed it through a 2.2k resistor into the base of an NPN power transistor to switch your 12V accessory relay, wiring it's collector and grounded emitter to J6. The relay coil connects between +12V and the collector.

The chassis-mounted mike connectors are mounted on the aluminum box enclosure, and are wired to bypass all signals except PTT and CW in/out.

You will need to make up jumper cables to mate with your transceiver's connectors. Be especially certain of the integrity of the connection from your AUX contacts and J6, since this provides closed-loop feedback to the sequencer. Another consideration is the connection between the sequencer and preamp/relays. I have tried in the past to use the main feedline shield as power ground to the preamp, with a single wire for switched Vcc. I can tell you from experience what happens if you forget to turn off your GaAsFET while unscrewing the feedline connector from your equipment. The inductive kickback, having no path to bleed off, blew a device. The diodes absorb the transient only while ground is connected. Use an unspliced length of RG-58/59, or some kind of shielded cable, for DC power to save yourself this experience!

Circuit Check-Out

It is advisable to test your circuit before wiring in your preamp head/coax relays. Connect your microphone and CW key to the sequencer. Make no connections to your transceiver yet. Obtain three LEDs and a 47 µF capacitor. Observing polarity, clip lead the 47 µF capacitor in parallel with C1. Solder 1k resistors in series with each LED. Observing polarity, clip lead the LED indicators across J5 switched Vcc and ground, J3 PTT out and +12V, and between J4 tip and +12V. Clip lead the J3 PTT out common point to ground. Apply 12 volts. The "preamp" LED across J5 should be the only one on. Place S2 in SSB position. As you key the mike PTT, you should just be able to perceive the "preamp" LED across J5 extinguish before the "PTT" LED across J3 comes on. When you unkey the mike, the LED across J3 should extinguish just before the LED across J5 re-lights.

Place S2 in the CW position and look for the same results, but at the "CW out" LED across J4. Check to see that you can briefly light the J4 LED with a "dah" from your key. Finally, short J6 tip to ground with a clip lead. The LED on J5 should remain off as long as this short is connected. This completes the checkout.

Operation

With everything in place, and S1 to preamp on position, S2 to SSB, when power is applied the preamp should be on. When you PTT the mike, you will just notice the receiver quiet before TX comes on. When you unkey, TX should go off before the preamp comes on. Set S2 to CW. Attempt to send a dah. The first dah will be abbreviated to a dit sound on your rig's sidetone if you use a keyer 13–20 wpm. This is normal, a result of the 110 ms delay. You will have to get accustomed to sending out an "extra" abbreviated dah at the start of each CW transmission. Alternatively, you can also flip S1 to bypass, start transmitting, and flip S1 back in the middle of your transmission. This manual bypass switch is wired so that the end of cycle delay is always present to protect your device.

Closing Comments

I have used this design at my station with a 2 meter multimode rig and a kilowatt amplifier for years with great success. If you are tempted to decrease the delay time, be aware that the average relay takes between 5 and 10 ms to close, but about twice as long to release as a result of the coil diode re-circulating current back into the collapsing field. The contacts are likely to have bounce for several more ms. Other things to consider are the switching times of your transceiver and accessory relays. Should you have a scope to measure and add these times up, plus a reasonable safety margin, and come up with less than 100 ms, you could then decrease C1 by a corresponding amount. I would not recommend it otherwise. 73

You may contact Ronald Klimas WZ1V at 458 Allentown Rd., Bristol CT 06010.

Simple Pulsed Crystal Signal Source

Find the right frequency.

by Leslie K. Bartoloth KA1MJP

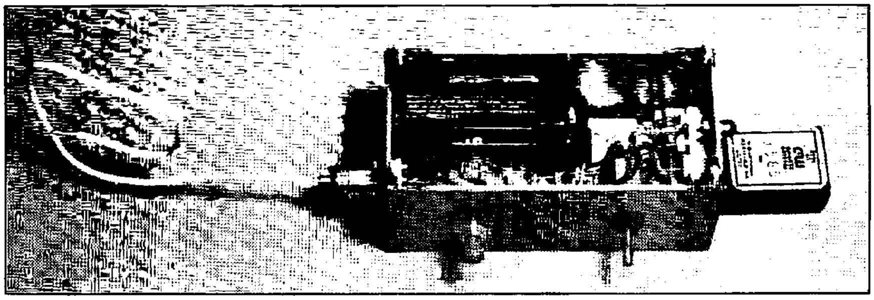


Photo A. This pulsed crystal signal source can help you find the right frequency in a crowded ham band. The author's prototype was built using the "ugly construction" technique, however a PC board pattern is available (see Figures 2 and 3).

First, a confession. I'd rather build than operate. Once I finish a project, I'll use it on the air for a few days, then I'll start on the next project.

I build and operate a lot of very simple rigs. My receivers are usually direct conversion (or regenerative!), and I sometimes have a hard time just finding the ham bands, let alone staying inside them. When I'm using a crystal controlled transmitter this isn't a problem, but I sometimes use simple VFO controlled rigs (like a Heath HW-7 or a home-brew transceiver) with inadequate dial calibration. With these transceivers, it's nice to have a crystal controlled spotting oscillator, like the one in Photo A. I just pop a crystal into the "chirper" and dial my receiver until I find the beeping signal source. Then I know I'm right where I want to be.

You can use this pulsed crystal oscillator to find the right frequency on a simple receiver, stay inside the band with an uncalibrated VFO transceiver, or to peak RF filters.

The "chirping" of this oscillator makes it easy to find in my receiver, even on a crowded ham band full of heterodynes. It also has a continuous-on mode so it can be used as a weak-signal source for peaking receiver preselectors and RF filters.

Circuit Description

See the schematic for the crystal chirper. The circuit couldn't be much simpler; its heart is a JFET crystal oscillator. Transistor Q1 switches the power supply to the oscillator. When Q1 is on, the oscillator runs. Crystal Y1 sets the oscillator frequency; this can be just about any crystal from 1 MHz up through 30 MHz.

Switch S1 provides a high at the base of Q1, switching it on and causing the oscillator to run continuously. I use this mode when I'm optimizing filters. Switch S2 (a momentary pushbutton) applies power to U1, a 555 timer IC connected as an astable multivibrator. The 555 runs at about five pulses per second, switching Q1 (and the crystal oscillator) on and off five times per second. I use the pulse mode when I use the oscillator as a spotter with my simple QRP rigs. It can be hard to stay in band with an uncalibrated transceiver, but once I spot the beeping oscillator, I know I can tune a bit to one side or the other and still be legal.

Because the RF oscillator does not run unless Q1 is switched on, and the 555 does not run unless power is applied through S2, the chirper draws no current when it is not in use. An ON/OFF switch is unnecessary, and a single 9-volt battery lasts a long time

Construction

Almost any construction technique will work with the chirper. I prefer "ugly construction," with all the components mounted up on one side of a scrap of PC board (as shown in Photo A). You could also use a Radio Shack prototyping board, or use the printed circuit board layouts in Figure 2 and 3.

I built the prototype inside a printed-circuit board enclosure, but shielding is not critical. In fact, you don't really want to shield this project! It's a signal source, after all, and you want the signal to get out and into your receiver. I built an earlier version inside a glass jar, and it worked great, even without the wire "antenna" shown on the prototype in Photo A.

I used crystal sockets for both FT243 and HC6 crystals in my prototype. I've had very good luck with crystals from CW Crystals, in Marshfield, Missouri. If you use these crystals, you'll only need an FT243 socket. You can also use alligator clips as a "socket" if you keep the leads short.

Parts Substitution

The parts shown in the schematic are simply the parts I used in my prototype. A wide range of parts values and types can be substituted for them. Q1 can be a 2N3904, 2N2222, or 2N4401 (or just about any other "generic" NPN transistor). Q2 can be a 2N5484 or 2N4416 instead of the MPF102 shown. U1 can be a plain-vanilla 555 (it may have numbers like NE555 or LM555, but it's the same part either way), or you can use the CMOS 7555 for even lower power consumption. At the low duty cycle of the chirper, you don't really need the more expensive CMOS part.

Any small-signal diodes will work as replacements for the 1N914s. 1N4148s are a good choice, and again, the generic Radio Shack parts will work here. The bypass capacitors (the 0.01 μF caps connected from the emitter of Q1 and the junction of the two

Continued on page 30

Parts List

Q1	2N3904 transistor
Q2	MPF102 FET
U1	NE555 timer IC
R1	1k resistor
R2	3.3k
R3,R5,R6	10k
R4	100k
C1,C2	0.01 μF capacitor
C3	10 μF electrolytic
C4,C5	100 pF
SW1	SPST switch
SW2	momentary contact switch (normally open)
RFC1	10 μH RF choke
XTAL	see text
D1,D2	1N914 diode
LED1	red LED

A blank PC board is available for $4 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Number 6 on your Feedback card

73 Review

by Thomas S. Rowinski KA1MDA

DigiMax D-1200 Frequency Counter

Great performance at a budget price.

DigiMax Instruments Corp.
8560 Production Ave.
San Diego CA 92121
Tel. (619) 578-7171.
Price Class: $300.

My test bench, assembled entirely from hamfest finds, consists mostly of older test equipment, which is both plentiful and relatively cheap. This type of equipment is still capable of very good performance, if you don't mind the bulk.

The recent acquisition of a non-functional 440 MHz HT, however, brought out one major weakness of my system: the inability to make precise frequency measurements above 250 MHz. I had one of those inexpensive "do everything" 600 MHz counters, but the accuracy was very poor and the drift was terrible! And my rock-steady lab-grade H-P counter was only good to 25 MHz! Adding an external prescaler could expand that range to 250 MHz, but with reduced sensitivity. It was time for a new counter!

An ad in *73 Amateur Radio Today* caught my eye. Although I had never heard of DigiMax Instruments before, they appeared to offer a variety of counters featuring excellent specifications at very reasonable prices. The art of specsmanship being what it is, I decided to take a chance on the DigiMax D-1200 and wring it out on the bench!

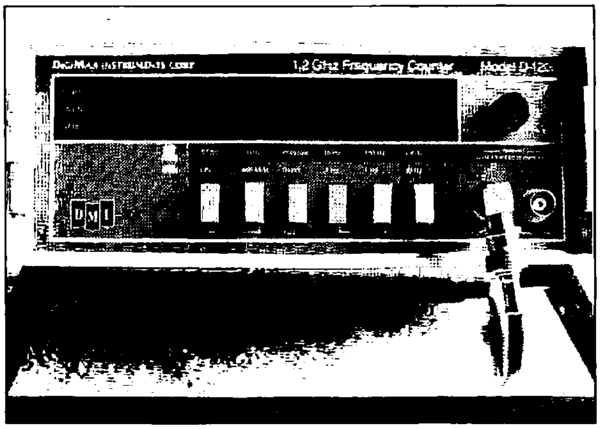


Photo A. Front panel view of the D-1200 frequency counter.

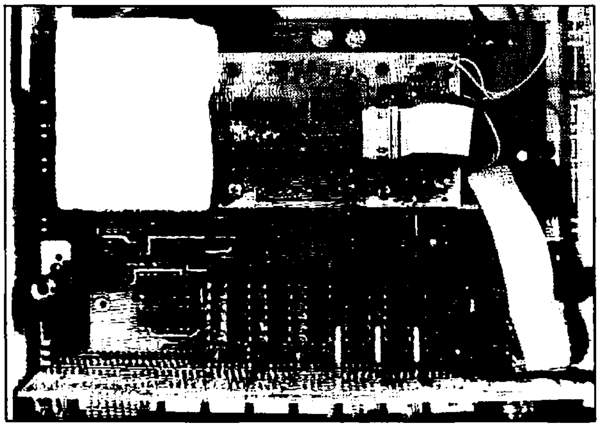


Photo B. Internal view of the D-1200 frequency counter.

The DigiMax D-1200

The DigiMax D-1200 measures approximately 3.5" H x 10" W x 9.5" D, and weighs in at just under three pounds, including the internal battery. The front panel (Photo A) includes two BNC input jacks; an input sensitivity control; an eight-and-a-half-digit LED display; LED indicators for STANDBY, OVEN, and GATE status; and a row of six push buttons for selecting time base, input, frequency range, and standby/on mode. Maximum display resolution is 0.1 Hz in direct mode, 10 Hz in prescale mode, and 0.01 Hz and 0.001 Hz using the X10 and X100 audio prescaler, respectively. The rear panel consists of a coaxial (barrel) type DC power input jack, a push-on/push-off master power switch, and a three-way toggle switch for selecting the various audio prescale modes.

The unit is housed in a light-colored textured plastic instrument case, and has a dark plastic carrying handle which also serves as a tilt bail. Power is supplied by a 12 VDC, 500 mA plug-in wall adapter/charger, or through an internal NiCd battery pack. Neither power source is supplied with the unit, although both the battery and charger/adaptor can be ordered from Digimax as options.

Finally, the D-1200 is supplied with a rather comprehensive users manual which includes not only instructions for using the frequency counter, but also block diagrams, schematics, calibration procedures, and a complete parts listing! DigiMax Instruments warranties the D-1200 for one year from date of purchase.

The Insides

The internal layout is clean and logical, and the unit appears to be well constructed (Photo B). The majority of the electronics parts are mounted on the large main PCB, which occupies most of the bottom of the enclosure. The 10 MHz proportional crystal oven is located on the main board and is housed within a rather thick styrofoam block, presumably for insulation purposes. A hole in the bottom of the case allows for easy access to a trimmer capacitor for calibration of the time base oscillator.

A smaller board mounted piggyback atop the main PCB contains the audio prescaler. The LED displays are mounted on a third printed circuit board at the front of the case, mounted at a 90 degree angle to the main board. All connections between the three PCBs are made with ribbon cable using DIP headers and sockets, making for easy disassembly and service, if ever required. A plastic battery holder for six C-sized cells is mounted inside the rear panel, complete with the charger circuitry. DigiMax offers a NiCd option for around $35, but all that is required to implement this feature is the installation of the six C-sized NiCd cells in the battery holder. If you already have these batteries at home, save the $35 and do it yourself!

Performance

The performance evaluation was conducted in two phases. First, I bench-tested the unit to verify the manufacturer's published specifications. For test equipment, I used a Hewlett-Packard 241A oscillator, 403B AC voltmeter, and 8654A RF signal generator; a Phillips PM6652C frequency counter; and a Soar 5030 digital multimeter. Due to equipment limitations, the RF tests were limited to a maximum frequency of 535 MHz. In the second phase, I used the D-1200 extensively in

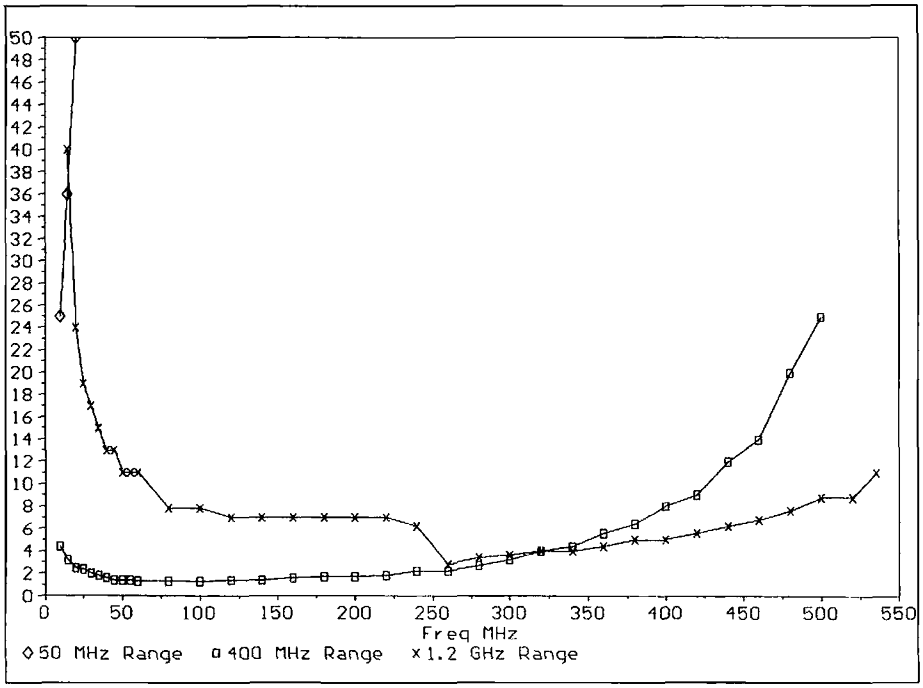


Figure 1. RF input sensitivity vs. frequency.

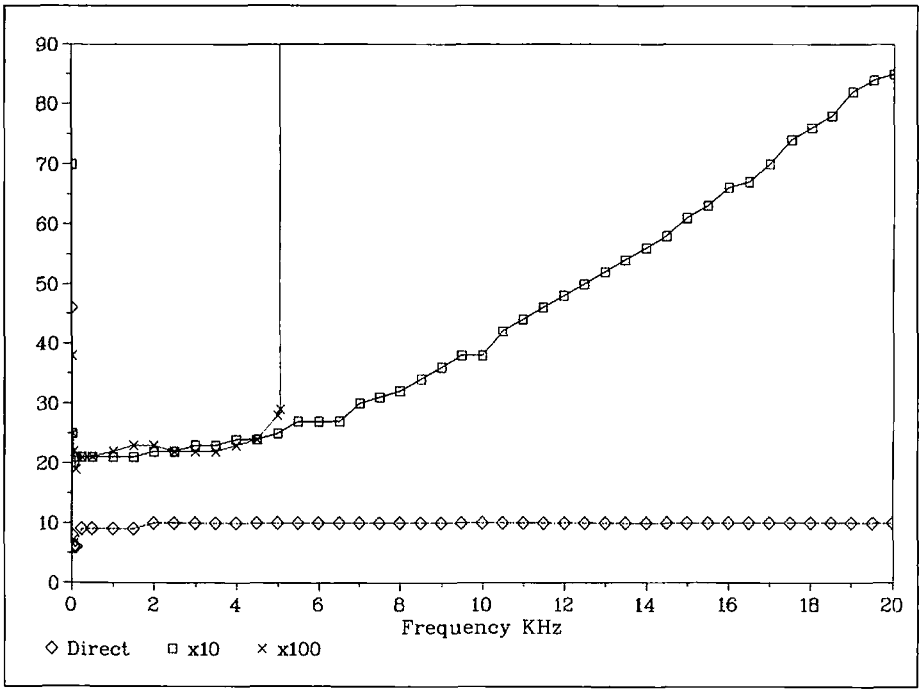


Figure 2. AF input sensitivity vs. frequency.

AF input sensitivity was measured on the direct input only, both with and without the internal audio multiplier in line. The results are shown in Figure 2. in direct mode, sensitivity was 10 mV over the entire audio range and remained there well into the RF range. With the X10 audio multiplier switched in, best-case sensitivity of 21 mV occurred at 1 kHz, and gradually rose to 85 mV at 20 kHz Using the X100 multiplier resulted in an input sensitivity figure of 20 to 30 mV, with a maximum frequency limit of 5 kHz.

Accuracy and drift were checked by feeding the output of a 10 MHz ovenized reference oscillator to both the D-1200 and a reference counter, and comparing the readings over a period of time. The reference counter had recently been calibrated to NIST traceable standards, and the test was conducted in an environmentally controlled room held at constant temperature and humidity. The D-1200 as received from the factory read 5 Hz low. Maximum drift after a two-hour warm-up period was no more than ± 0.3 Hz over the next five hours (yes, that was 3/10 of one hertz)! The input sensitivity control had a range of approximately 37 dB on the prescale input, and had no effect on the direct input. Power consumption was 50 mA when charging the battery pack, 200 mA in "standby" mode (oven on), and 550 mA when the counter was operational. The unit will operate with a supply voltage of 9 to 14 VDC.

Operation

The DigiMax D-1200 was very easy to use. All the controls functioned as designed, and the two-tone color layout of the front panel helped avoid any confusion as to the control settings. The front panel power button switches the unit between "on" and "standby" mode. (In standby, all electronics are powered down except for the crystal oven and time base oscillator). When in standby, a front panel LED lights to alert the user of the increased battery drain. The main power switch on the rear panel switches off power to all the circuits. This is handy when prolonged battery operation is required, at the expense of some stability. The batteries are automatically trickle-charged whenever an external power source is applied to the D-1200's power jack, regardless of the main power and standby switch settings.

a number of environments, including bench-top, mobile, and field-portable operation. The purpose here was to uncover any flaws in its ergonomics, construction or materials.

Electrically, the unit performed quite well. Figure 1 shows the RF input sensitivity of the DigiMax D-1200 as a function of frequency. The direct input sensitivity, corrected to 50 ohms, ranged from 25 mV to 300 mV at 10 MHz and 55 MHz, respectively. The 400 MHz range prescaled input sensitivity registered between 4.4 mV and 25 mV at 10 and 500 MHz, respectively, with a best figure of 1.3 mV at 80 MHz. The best 1.2 GHz range prescaled input sensitivity measured was 2.8 mV at 260 MHz, with a worst case sensitivity of 40 mV occurring at 15 MHz.

Manufacturer's Specifications for DigiMax D-1200 Counter

Frequency Range	10 Hz–50 MHz (Direct)	
	10 MHz–1.2 GHz (Prescale)	
Sensitivity	10–50mV typ.	50 Hz–25 MHz (Direct)
	10–50 mV typ.	25 MHz–300 MHz (Prescale)
	20–100 mV typ.	300 MHz–1 GHz (Prescale)
Resolution	0.001 Hz, 0.01 Hz (Audio Scaler)	
	0.1 Hz, 1 Hz, 10 Hz (Direct)	
	10 Hz, 100 Hz, 1 KHz (Prescale)	
Time Base	10 MHz crystal proportional oven	
Accuracy	±0.05 ppm (20–40 degrees C)	
	±1 count	
Aging	1 ppm per year, typ.	
Input Impedance	1 Megohm / 20 pF (Direct)	
	50 Ohms (Prescale)	

One area which caused some minor confusion was the crystal oven indicator. On some days, the "oven" LED would go on as soon as I switched the counter on. At other times, it took 30 to 40 minutes for the LED to come on. Fearing I had an intermittent crystal oven, I called DigiMax, and a quick chat (yes—I talked to a real, live, knowledgeable human being on the first try!) put my concerns to rest. On my older equipment, the oven indicator turns on whenever the heating elements are energized, showing the oven is operating. On the DigiMax D-1200, the oven indicator goes on when the oven has reached operating temperature! I guess I was used to the old school. The system used on the D-1200 is actually more logical, since illumination of the oven LED shows when oven temperatures have stabilized, which corresponds with best accuracy and lowest drift! Special thanks go to Mr. Dan Burton (who I later learned was the president of DigiMax!) for not only explaining the operation of the LED, but for taking the time to describe the associated circuitry and design features in detail.

Observations

The D-1200 was not, however, entirely void of problems. There were some minor flaws, mostly relating to the materials used. The front panel power/standby switch is colored red to set it apart from the other push buttons. The red color, unfortunately, is painted on the plastic, not molded in. Within three weeks, enough paint had chipped off the switch to make me want to scrape the rest off! Luckily, the poor paint adhesion made this a five-minute job using nothing more than my fingernail!

The plastic carrying handle, which doubles as a tilt bail, was a bit on the flimsy side. The handle flexed considerably, and the positioning mechanism (also made of plastic) had a sloppy and vague feel. These two minor points were the biggest flaws of the D-1200. Although neither impaired the counter's usefulness, they gave it a "cheap" feel and detracted from the otherwise excellent performance of the unit.

The D-1200 is supplied with plastic feet, but they are made of hard plastic. This, together with the relatively light weight of the counter, caused it to slip and slide excessively when placed on hard, smooth surfaces such as plastic, finished wood, or metal.

The coaxial power jack on the rear panel was an odd size. Not that it was non-standard (Radio Shack sells the mating plugs), it was just a type seldom used on other electronic equipment.

Finally, there were many times when I would have liked to stand the counter up vertically, on its rear panel. This was not possible, however, due to the shape of the case and the positioning of the main power and audio prescaler switches. Both of these switches projected beyond the rear of the instrument, making it very unstable.

Modifications

There are a few easy modifications which can be done to make the D-1200 more user friendly. First, get a set of large, square rubber self-sticking feet (available at Radio Shack) and apply them to the bottom corners of the case. This will instantly fix the slipping and sliding problem on hard surfaces!

Next, get four pieces of hard rubber, cut into 3/4" cubes. Using Super Glue™ or epoxy, glue these onto the corners of the rear panel. These blocks will serve as legs, and will make it possible to stand the counter up vertically for field use in cramped quarters.

For the more adventurous, get four switching diodes, such as the 1N914 type available at Radio Shack, and solder two diodes in parallel, front-to-back (cathode-to-anode, and anode-to-cathode). When done, you should have two sets of diodes. Now solder one pair of diodes from the center conductor of each of the BNC input jacks to ground, keeping the leads as short as possible. The diodes will conduct any time the signal level rises above 0.7 volts or so, protecting the counter input from overload. This modification should only be undertaken by those skilled in soldering delicate solid-state equipment!

Finally, I replaced the DC power input jack with a jack of the same size as the one used on my ICOM 2AT, allowing me to use one cable to power all my equipment from the mobile! This last modification is one of convenience only.

As always, before modifying any piece of gear, make sure the unit is functioning properly and out of warranty. Most manufacturers will not honor warranties on equipment which has been modified by the user. Play it safe and wait for the warranty to expire!

A Great Bargain

I have owned my unit for well over nine months now, and it has held up extremely well, even after a few minor drops (not recommended). Although test equipment limitations prevented any testing above 535 MHz, the D-1200 met and exceeded all the manufacturer's performance claims up to that frequency. Based on those results, I would accept the published specifications as valid, real-world performance data and fully expect the unit to perform as advertised all the way to its 1.2 GHz limit.

The DigiMax D-1200 frequency counter offers performance that was inaccessible to the average ham only a few years ago. To find such a level of performance in this price range is truly amazing! Although it did have a few minor faults in the area of material and finish, none of these in any way impaired its usefulness or accuracy. The clear, well-documented manual and excellent customer support were also welcome surprises!

Note that the D-1200 is strictly a frequency counter; it won't measure interval, period, or all those other functions of the fancy counters, but then it doesn't cost anywhere near as much, either! If the audio prescaler function isn't required, you can save $40 by ordering the DigiMax D-612 counter! On a scale of one to 10, I would rate the DigiMax D-1200 a solid nine, and strongly recommend it to anyone looking for a high performance frequency counter on a budget. ■

An ATV Downconverter with a Difference

Keep FM voice repeaters out of your picture.

by Don C. Miller W9NTP

How many times have you been working ATV on 439.25 MHz lately and an FM voice repeater wiped out the incoming ATV signal? You probably either condemned your downconverter for not having good selectivity, or you thought a few uncomplimentary things about repeaters in general. Then, on closer investigation with a tunable receiver, you found to your horror that these repeaters were in the passband of the ATV signal. Why do they do this? Don't hams respect each other's rights anymore? The truth is that the repeater is operating legally within its allocation, and the ATV station is as well. Figure 1 shows the relationship between the ATV band and the voice repeaters.

This is just one of the many problems that ATVers face today. Fortunately there is a technical solution to this problem that is both inexpensive and easy to do. Members of the Indianapolis ATVers group figured out the solution about 10 years ago. As a result, FM voice repeater interference is virtually unknown to them.

Design Background

Before discussing the solution, let's look at the way an NTSC TV set receives a commercial channel. On Channel 3, for example, the video carrier frequency is 61.25 MHz. In order to conserve spectrum, TV channels were allocated 6 MHz. Since NTSC video signals are at least 3.58 MHz wide, it wasn't possible to fit both sidebands, the color NTSC spectrum, and the sound carrier into the 6 MHz bandwidth. The diagram in Figure 2 shows the normal video and sound spectrum used to modulate a TV transmitter.

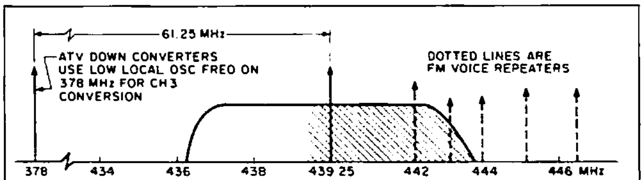


Figure 1. A typical ATV spectrum, showing FM repeaters and upper sideband detection normally used.

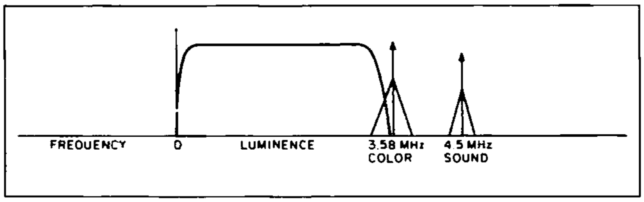


Figure 2. NTSC video spectrum with sound subcarrier.

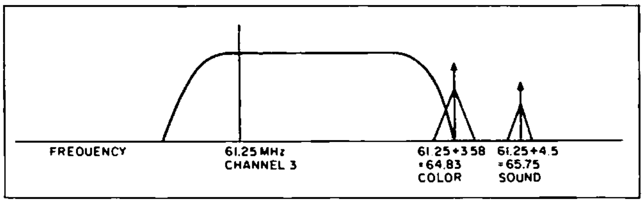


Figure 3. Typical Channel 3 vestigial sideband transmission.

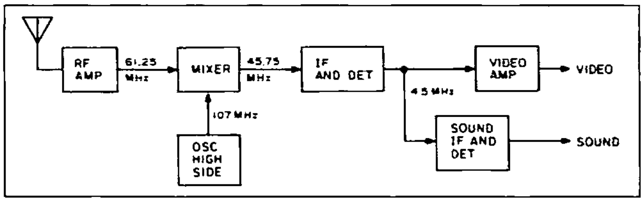


Figure 4. Block diagram of a typical TV receiver.

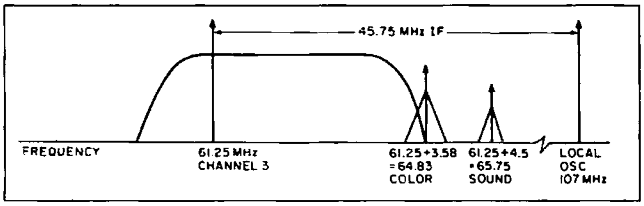


Figure 5. Conversion of upper sideband TV to lower intermediate frequency sideband by the use of a higher frequency local oscillator.

Early investigators found that if a system of vestigial sideband transmission was used, the TV signal could be transmitted with a total bandwidth not exceeding the allocated 6 MHz. The vestigial sideband system only used slightly more spectrum than a single sideband transmission system. SSB could not be used because of the need for a relatively accurate carrier insertion. They found that most of the energy of a video signal is in the first one megahertz of the bandwidth, and that if double detection of that portion of the transmitted signal was made, the total signal could be placed within the 6 MHz bandwidth.

In other words, the first one MHz of the spectrum is detected as double sideband with bandwidth attenuation, and the rest of the signal is detected as single sideband. The carrier is transmitted as part of the double sideband transmission. This spectrum is shown in Figure 3. Note that the upper sideband was chosen to be the preferred sideband, but the lower could just as well have been chosen.

All TV sets use the principle of superheterodyne, discovered in the late 1920s, which makes it possible to build just one amplifier to amplify any received frequency. Before this development, it was necessary to tune all the RF stages of a radio to every frequency that the listener desired to receive. This was partly solved by ganging all the RF stages together so that all the knobs did not have to be tuned carefully. This took a lot of the fun out of listening to the radio.

Figure 4 is a block diagram of a simple radio or TV set. The RF stage may be tuned, but tuning is not absolutely necessary. The frequen-

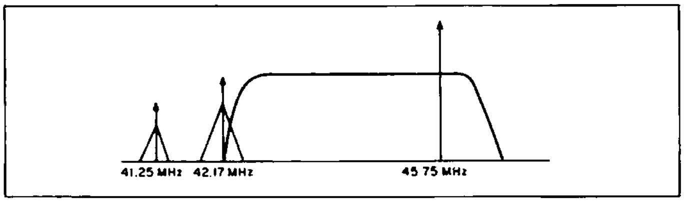


Figure 6. Spectrum of an upper sideband TV signal after it has been frequency-inverted by a higher local oscillator.

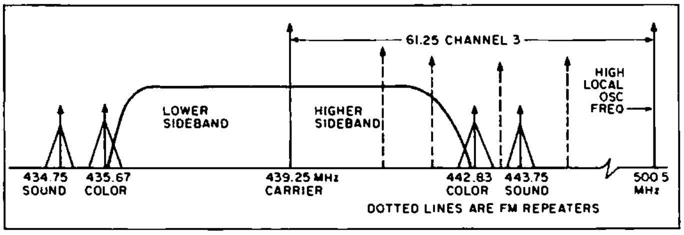


Figure 7. Higher local oscillator at 500.5 MHz converts the lower sideband of the ATV signal to an interference-free signal.

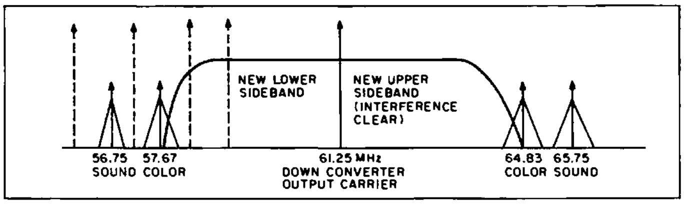


Figure 8. Resulting downconverter spectrum after higher frequency oscillator inverts spectrum.

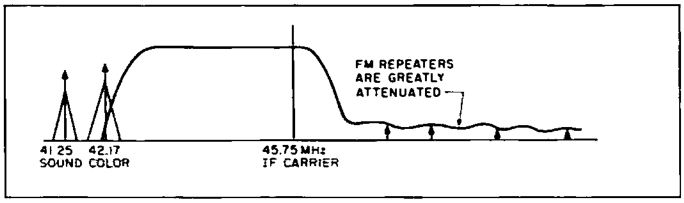


Figure 9. Lower sideband of transmitted ATV signal in the passband of the IF amplifier, showing the attenuation of the FM voice repeaters.

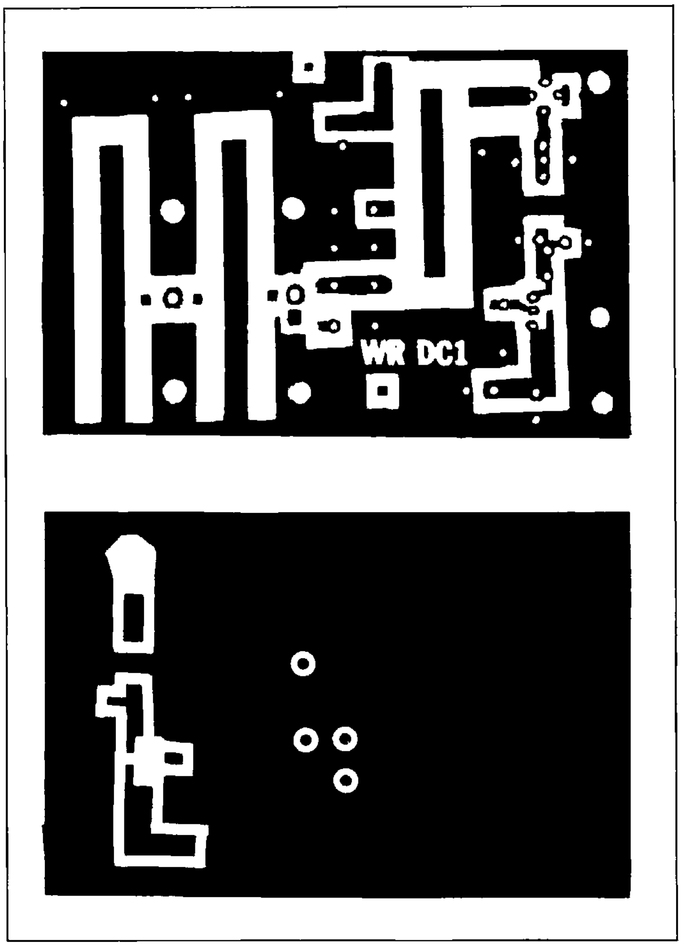


Figure 11. (a) PC board foil pattern (top layer). (b) bottom layer foil pattern.

cy selection tuning is done by the Local Oscillator (L.O.). In older TV sets, this frequency, as well as the RF tuning, was done by a channel selector, but in new sets, varactor electronic tuning eliminates the need for these mechanical nightmares. To receive an incoming signal, e.g., Channel 3, on 61.25 MHz, the vestigial one-sided spectrum must be converted to such a frequency that the intermediate frequency amplifier, known as the IF, can amplify it. Since all channels must be converted to this IF frequency, a frequency must be chosen that is least likely to be interfered with. Various intermediate frequencies were used in early TV sets, but interference from other services was found to be very bad. Later, an IF frequency near 45 MHz was chosen. It has worked very well for the last few decades.

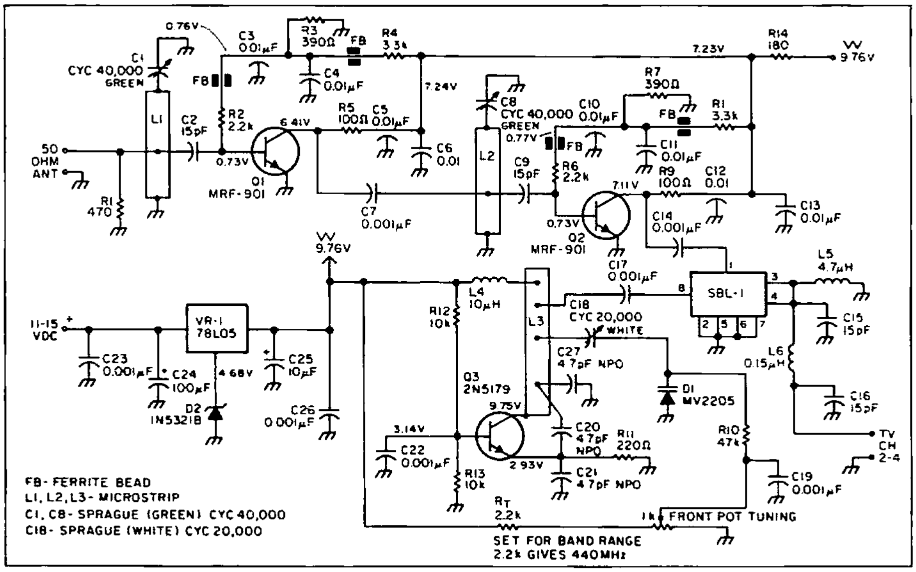


Figure 10. The lower sideband ATV down converter.

The second design standard that must be set is placement of the L.O. A frequency above or below the IF is acceptable. The L.O. frequency can be 61.25 plus 45.75 = 107.00 MHz, or 61.25 minus 45.75 = 15.50 MHz. The TV receiver manufacturers decided to use the higher L.O. frequency. The IF amplifier cannot tell which L.O. was used. The higher L.O. ensures that the oscillator does not fall in any VHF TV channel when the receiver is tuned to VHF channels 2-13.

When UHF came along, the same standard was used. It was desired to use the unsymmetrical IF amplifier response set up for VHF reception. This is what has created a problem for ATVers on 439.25 MHz.

Now, the Fix

Figure 5 shows the conversion spectrum of the Channel 3 TV signal. Remember that the upper sideband is the chosen sideband transmitted commercially. When this upper sideband is received, it becomes LOWER SIDEBAND in the IF amplifier. This is shown in Figure 6.

When ATV came along, it was easy to build a downconverter that would convert 439.25 MHz to Channel 3 or some other low frequency channel. If Channel 3 was the

choice, the designer of the downconverter had to decide where in the spectrum the downconverter L.O. would be placed. It is difficult to build oscillators in the UHF spectrum, so some manufacturers decided that the L.O. should be placed on the low side of 439.25 MHz, or 439.25 −61.25 = 378 MHz. The other choice would have been 439.25 + 61.25 = 500.5 MHz which would result in lower sideband detection.

The lower frequency L.O. choice was also influenced by falsely concluding that the upper sideband of the two-sided ATV signal *must* be the sideband that is received by the TV set. Another consideration was that it is more difficult and expensive to design and build a higher frequency L.O.

Both sidebands are transmitted by many ATV transmitters, and the picture is the same whether the upper or lower sideband is recovered. Figure 7 shows how an oscillator on the high side of the ATV carrier can detect the same picture.

If the choice had been to place the ATV L.O. on the high side of the incoming signal, the lower sideband would have been detected WHERE THERE ARE NO FM REPEATERS. This mostly eliminates the FM interference. The passband of a typical TV set rejects anything on its IF higher sideband. Remember that the sidebands REVERSE in the IF amplifier. The rejection of the upper sideband in the ATV spectrum is as good as the rejection of the TV set IF amplifier. This varies from TV to TV, but the rejection is good enough to reject adjacent channels on cable TV where channels are side by side. This is different from commercial RF transmitted TV, where adjacent channels are now allowed within a certain geographical distance.

The conversion is shown in Figure 8. A typical IF passband characteristic is shown in Figure 9.

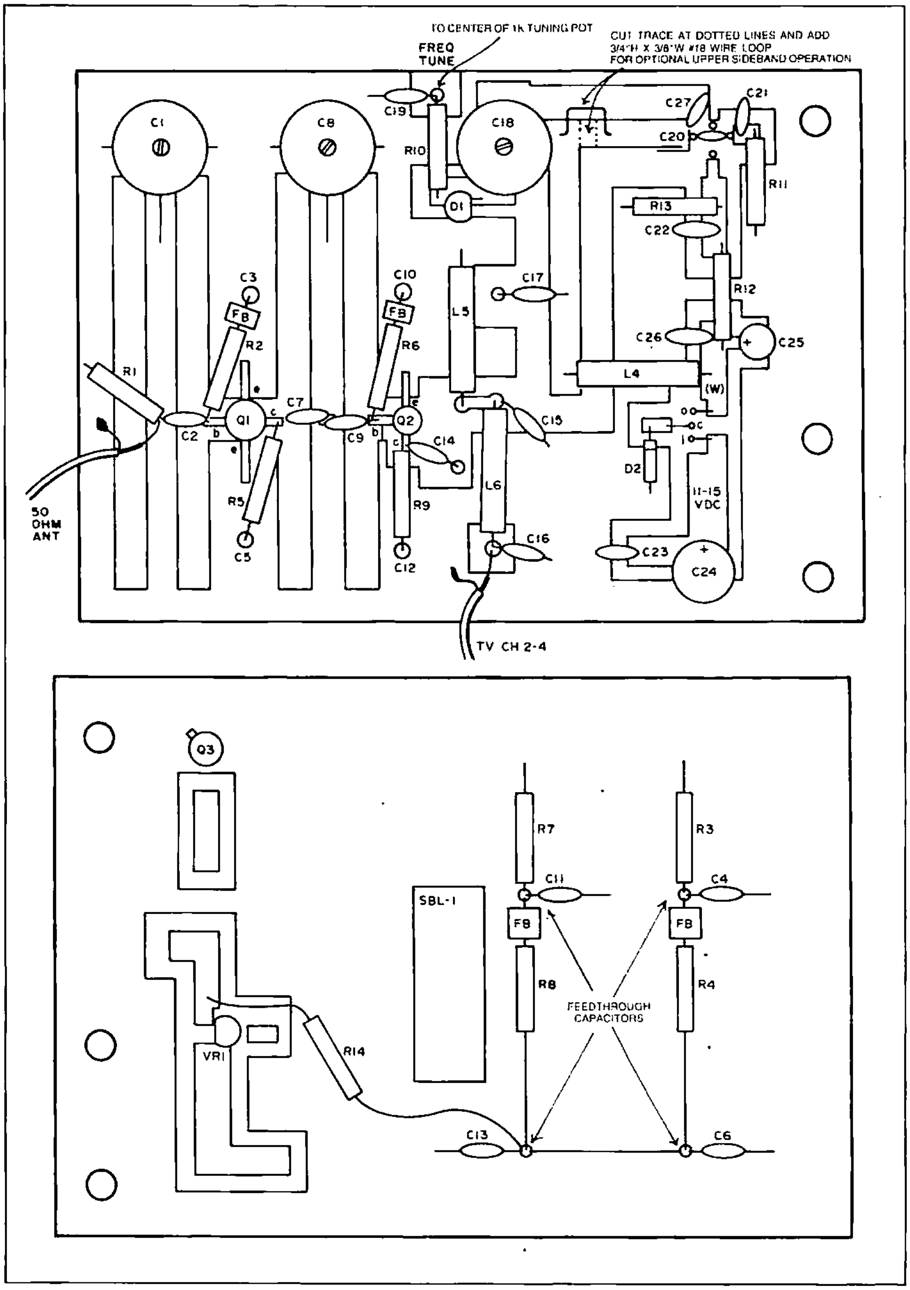


Figure 12. (a) The mechanical layout on top of the PCB. Mount components right on top of the board. To modify the circuit for upper sideband receive, cut the trace indicated by the dotted lines (L3) and attach a 3/4" high by 3/8" wide #18 wire loop to bridge the gap as shown in bold lines. (b) The bottom of the PCB. Note that Q3, the SBL-1 and the other components shown here are soldered to this side of the board.

Build your own Downconverter

It is easy to build a downconverter that receives the lower sideband. If you do not wish to modify your present downconverter, why not build one yourself? Figure 10 shows a circuit that works very well for ATV and operates with the oscillator on the upper side of the received frequency.

The incoming signal is amplified by two MRF-901 transistors. Stripline inductors are used on both stages of the RF amplifiers. The oscillator is also stripline, and is varactor tuned with a potentiometer on the front panel. The mixing between the incoming signal and the oscillator is done in a 4-diode mixer. The output is filtered and put out to an F-type connector that is connected to a TV set tuned to Channels 2–4.

Each of the RF stages are decoupled with well-filtered DC voltages supplied through feed-through capacitors. The noise figure of the downconverter is excellent, and rivals the performance of more expensive GaAsFET front ends. If desired, a small GaAsFET amplifier, such as the Hamtronics LNW-432, can be put in front of the downconverter. In this case, the first stage of the downconverter can be eliminated, and the GaAsFET output is connected directly to the base connection on the microstrip of the second stage in the downconverter. You'll see some improvement in performance when using the GaAsFET preamp, although the noise figure of the MRF-901 front end is very good. Figure 10 shows the circuit diagram of the lower sideband downconverter. Figure 11 shows the printed circuit board layout, top and bottom, and Figure 12 the parts layout.

Tune-Up and Operation

Mount your downconverter in a metal enclosure with a BNC or N connector for the antenna input and an F connector for the channel 3 TV output (you can use VHF channels 2–4). Hook up the downconverter to the VHF input of your TV set and attach a good 70 cm antenna to the BNC or N connector.

Power up the downconverter (use a 12-volt supply) and set your TV set for channel 3. Use channel 2 or 4 if you have a strong local station on 3. Have a nearby station who can transmit a low power signal on the low end of the band on either 421.25 or 426.25 MHz (or look for the output of an ATV repeater), adjust the front panel tuning potentiometer for the low end of its range and adjust capacitor C18 until you see a picture. If you find that you cannot tune high enough, you may have to use a lower value resistor for Rt (try 2.0k instead of 2.2k in this instance).

If you can't generate anything on the low end, just have someone send on 434 or 439.25 MHz, and tune the potentiometer to

the upper end of its range. Then just adjust C18 for a picture.

Once you receive an image, have the transmitting station reduce his power or move his antenna until you have a weak, snowy picture. Now peak capacitors C1 and C8 for the strongest image.

Selectable Sideband Options

If you have no interference problems on 439.25 MHz in your area, or operate on other frequencies in the band (434, 427.25, 426.25 or 421.25 MHz), you can use this downconverter to receive regular upper sideband transmissions by cutting the trace to the right of C18 (see option in Figure 12a) and adding a 3/4" high by 3/8" wide #18 wire loop to bridge the gap. You will need to do this if you are receiving ATV transmitters or repeaters that use vestigial sideband filtering.

For the more adventurous, you can add the loop for upper sideband receive, then mount a small relay on the bottom of the PC board so that the pins short out this gap when activated. That way you can receive upper sideband ATV in one position, and lower sideband when the relay is closed. You'll have to experiment around to find the right length of the #18 wire loop so that you tune the same frequency whenever the relay is activated. Otherwise you'll have to readjust the tuning potentiometer or tweak C18.

The ATV LSB Downconverter

R1	470 ohms
R2,6	2.2k ohms
R3,7	390 ohms
R4,8	3.3k ohms
R5,9	100 ohms
R10	47k ohms
R11	220 ohms
R12	10k ohms
R13	10k ohms
R14	180 ohms
C1,8	1–10 pF variable, Sprague, CYC 40,000 (green)
C18	1–15 pF variable, Sprague, CYC 20,000 (white)
C2,9,15,16	15 pFdisc
C3,5,10,12	0.01 feed-thru noncritical value
C4,6,11,13	0.01 µF disc
C7,14,17,19,22,23,26	0.001 µF disc
C20,21,27	5 pF NPO
C24	100 µF electrolytic
C25	10 µF electrolytic
L4	10 µH choke
L5	4.7 µH choke
L6	0.15 µH choke
Q1,2	MRF-901
Q3	2N5179
VR1	78L05
D1	MV2205
D2	1N5231 Bzener
SBL-1	double balanced mixer Mini-Circuits

Note: A blank PC board is available for $10 from the author at Wyman Research, Box 95, RR #1, Waldron IN 46182, or call (317) 525-6452. The following hard to find parts are also available: Sprague CYC 40,000 and CYC 20,000 variable capacitors at $4 each and the SBL-1 double balanced mixer for $5.

After you've done your tune-up procedure, you should be ready to join in on all the ATV action and you'll keep the voice repeaters interference out of your picture in the process.

Don C. Miller W9NTP, Box 95, RR 1, Waldron IN 46182.

Crystal Signal Source *Continued from page 14*

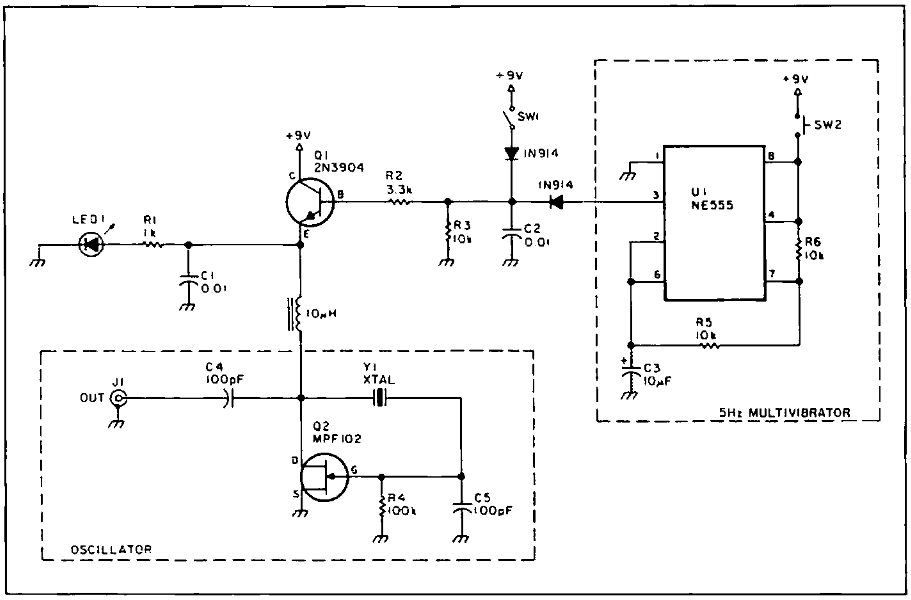


Figure 1. The "crystal chirper" circuit. Its heart is a simple JFET Pierce crystal oscillator.

diodes to ground) can be any value from 0.001 to 0.1 μF.

The RF choke can be just about any value from 10 μH through 2.5 mH. The 100 μH choke Radio Shack sells works fine, although it's a bit large for a small project. If you want to wind a smaller choke, 15 turns of number 24 or 26 wire on an FT37-43 or FT50-43 ferrite toroid produces a choke in the neighborhood of 100 μH.

The 10k resistors and 10 μF capacitor connected to the 555 are fairly critical—they set the pulse rate of the 555 circuit. You can change their value slightly if you'd like faster or slower pulses. Reducing the resistance or capacitance will speed up the oscillator; increasing either will slow it down.

Even the supply voltage is not critical. The circuit will operate anywhere from about 6 volts up to 18 or so.

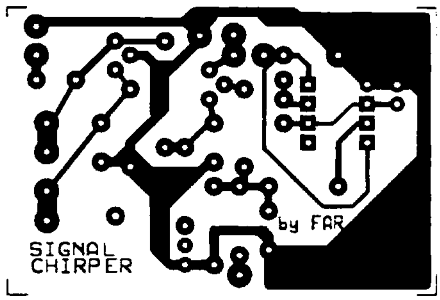


Figure 2. The PC board foil pattern for the pulsed signal source.

Adjustment and Calibration

There's not much to adjust on this project. It should work the first time you turn it on. Plug a crystal into the circuit and switch on S1. If you have an oscilloscope, check for RF at the output jack.

If you don't have an oscilloscope, you can use a receiver to test the chirper. If you built the project in a shielded enclosure, you'll need a small wire "antenna" like the one shown in Photo A. If your version of the chirper is unshielded, place the project near your receiver and tune around near the crystal frequency. You should hear a steady tone when S1 is switched on, and a pulsed tone when you switch S1 off and press S2. The LED should also light steadily when S1 is on, and flash when you press S2.

If you have S1 switched on, don't expect the circuit to pulse when you press S2. The two 1N914 diodes make an OR gate—either pulses from the 555, or steady DC through S1 will turn on the oscillator. Once S1 is on, pulses are simply ignored. If you have any problems, check your solder connections, and then make sure supply voltage is flowing to all the appropriate points in the circuit.

If the LED comes on when S1 is on, but it does not flash when you press S2, something is wrong with the 555 oscillator. Once you have the LED behaving, if there's still no output, check your connections in the crystal oscillator portion of the circuit. Then, try a different crystal; some older FT243 crystals can become corroded and stop working. Next, if the supply voltage at the drain of Q2 seems adequate, and you've tried a few different crystals, try substituting a different transistor for Q2. Finally, experiment with the value of the 100 pF capacitor from the gate of Q2 to ground.

I had fun building this project, and I use it often. I'm sure you'll find it easy to build, and it will be a valuable addition to your test bench or operating table. Now that you'll be right on frequency, put that simple transceiver on the air! 73

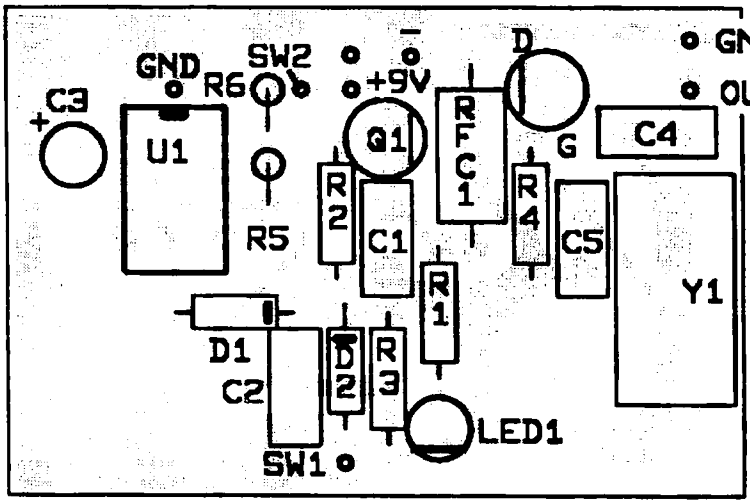


Figure 3. PC board parts placement.

Leslie K. Bartoloth, 2238 168th Ave. N.E., Bellevue WA 98008.

Using RS-12

Work the world with this unique satellite.

by Pat Gowen G3IOR

[The RS-12/13 amateur radio transponders were launched from Plesetsk, Northern USSR, on February 5, 1991, as an attachment on the USSR COSMOS-2123 navigational satellite, sharing the same power supply and housing. They went into a polar 82.9°-to-earth-equator 1,000 km high orbit which takes 104.8 minutes to circle the earth. RS-12 and RS-13 are both free for use by all of the earth's radio amateurs.]

Most satellite enthusiasts are, like most trackers and computers, geared to working their satellites of interest from "AOS" to "LOS," i.e. from the moment it appears above their terrestrial horizon, the "Acquisition of Signal," to the "Loss of Signal" point, when it normally disappears until the next pass. Unless intense "E" layer ionization or pre-auroral F2 enhancement exists to help re-angulate the uplink and/or downlink signals to and from satellites, it is rarely possible to use the VHF and UHF transponders more than 3° below the user horizon. This limitation is not the case with HF satellites, as the signals are often above or close to the MUF (Maximum Useable Frequency), considerable re-angulation of the uplinks and downlinks can result as they pass through the active layers.

Another phenomenon is also apparent at HF that is the reverse of what you would expect for UHF/VHF transponding. While the 2m and 70cm downlinks are always heard immediately after the source of the signal is above the horizon, the low angle of incidence, hence the long traverse through the E and F layers at horizon, can attentuate 29 MHz downlink signals close to extinction, and the 21 MHz uplink totally so that "K" mode access is impossible even with high power!

It is these factors that make RS-12/13 so fascinating a propagation path indicator, and a super-DX satellite to boot! This effect is not new; way back in the early days of OSCAR-6, both DJ2RE and G3IOR wrote papers on this phenomenon of the 29 MHz downlink. Both G6RH and G3IOR exploited it to the full in order to work a number of stations that were "officially" out of mutual access so as to earn "DXCC Satellite" when only 72 active countries were in theoretical range of them.

UoSAT OSCAR-9 followers will recall that the 29 MHz beacon would invariably appear long before the 145 MHz telemetry, the 21 MHz before this, and the 14 MHz even more than 20 minutes before the official "AOS." The 7 MHz beacon was never heard, as it was unable to penetrate through the ionized layers at that very low frequency. Similarly, OSCAR-6 and 7 users, as well as past and current "RS" series enthusiasts, will all have heard the 29 MHz beacon coming in long before (and long after) those times when the 2m uplink could access the spacecraft transponder. The European users suffered the agony of hearing JA, W6 and 7, Pacific Island and far South America and other mouthwatering DX which could not be worked due to limitations of the "line of sight plus a bit" VHF uplink signal path.

RS-12 on mode "K," 21 MHz up from earth to the satellite, 29 MHz down from satellite to earth, offers no such uplink and limitation frustrations! Not only can it provide excellent sub-horizon audibility, but access to the transponder as well! Although only some 600 miles high, due to the propagational anomalies at HF, RS-12 on Mode "K" can put you in range of all of earth's continents. The results are very different from those found on the Mode "A," "B," "J," and "L" transponders, where antipodal stations have no common time view, even at 34,000 km satellite height apogees. The 21 MHz uplink will re-angulate to an even greater degree than RS-10's 29 MHz downlink.

Despite the enormous possibilities, no more than 40 stations in all of Europe, and some 100 different stations worldwide, are to be heard using RS-12's "K" mode. Only eight stations are regularly active in the UK, only 30 in Europe, and only 15 have been worked from W1, 2, 3, 5, 8, 9 and 0. Surprisingly few HF "F2" operators seem even to know of the existence of RS-12, as few among their ranks seem to follow the exciting developments happening in the world of amateur radio satellites. It is perhaps because many HF operators associate satellites with the terrestrial limitations of VHF and UHF, the need for additional costly specialized equipment, and possibly because many believe that satellite operating is an art outside the normal run of their communications.

With RS-12's mode "K" none of these assumed limitations apply because we have now in orbit the new Soviet HF transponding satellite, the brainchild of Leo Labutin UA3CR. It uses the high frequency amateur bands and the basic equipment that most licensees have in their shacks, and does not require extensive high-gain beams either.

RS-12 Transponder Basics

The new Soviet RS-12 satellite has its uplink receiver listening to a 40-kHz-wide segment of the 15m band, and sending the content out again in similar 40-kHz-wide sections of 10m, and sometimes the 2m band as well. Despite transponding only a few tens of milliwatts per signal, it produces strong downlinks in the 10m (and when in mode "T" or "KT," the 2m) band, which may be heard sandwiched between the 25 wpm Morse CW telemetry beacon and the multiple speed CW ROBOT.

Telemetry

Although little active recently, the 25 wpm 2m CW telemetry beacon is centered on 145.9132 MHz, shifting from 145.9164 to 145.9100 during an overhead pass, due to the Doppler effect. The 10m beacon, which is on continuously, shifts from only 29.4086 to 29.4074 MHz. The telemetry will tell you all about the temperature, voltage, power, attentuators and general housekeeping parameters in different sections of the transponder and satellite. Table 1 lists all of these, but I will describe some of the more useful values and translation, as they will tell you what on-board devices are active and, among other indicators, the receiver's input attenuation.

Channel 3, if indicating IAS, IAD, IAR, or IAG, shows that the 15m receiver −10 dB attenuator is in circuit, while if it reads IAU, IAK, IAW, or IAO, no attenuation is in. The number following this shows the output power of the 10m transponder transmitter in watts by merely dividing the number sent by 10.

Channel 7 indicates the power level of the 10 meter No. 1 beacon on 29.407 MHz, where if NAS, NAD, NAR or NAG is sent, is minimum at 0.45W.

Channel 8 is the same for the second beacon on 29.453 MHz, where NMS, NMD, NMR and NMG all indicate the maximum power 1.2 watts of output power in use, while NMU, NMK, NMW and NMO all show that 0.45 watts, the minimum power output, is in use.

Channel 14 gives the attenuation of the 15m ROBOT receiver, with MNS, MND, MNR and MNG all showing −10 dB attenuation, while MNU, MNK, MNW and MNO all indicate that there is no attenuation in the front end. The number following this shows the ROBOT AGC voltage, as dividing the number transmitted by five will give the AGC in volts.

By observing and using these values, you will get much information on path attenuation and sub-horizon signal enhancement, giving an excellent ionospheric top-sounder for use in the experimental work and propagation research.

Robot Auto QSO'er

The ROBOT is a very clever fellow who

RS-12/13 Telemetry Data Conversion

The telemetry from RS-12 and 13 is sent down as Morse code CW at around 25 wpm. It represents various status indicators and measurements made on the transponder. There are 16 channels sent. Each channel sent consists of 3 alpha characters followed by 2 numeric characters; for example: IMS 45. The "IMS" part is the alpha. The "45" is the numeric part of one channel. The alpha part gives a specific status, such as "on" or "off" for a specific feature. In the example "IMS 45," the "IMS" part gives the specific status of Channel 4; the 21 MHz receiver is off. If, however, "IMS" is replaced by "IMU" in Channel 4, as in "IMU 45," then the 21 MHz receiver is activated (on). The numeric part of Channel 4, "45" in our example, gives the AGC level of the 15 meter receiver, where the value in volts equals the number sent divided by 5 (N/5 = V; 45/5 = 9 volts).

Channel	Alpha Group	Meaning/Conversion Formula
1	IIS IID IIR IIG	Telemetry sampling period: 90 min.
	IIU IIK IIW IIO	Telemetry sampling period: 10 min.
		N/4 = V in volts of power supply
2	INS IND INR ING	2m RX: 20 dB, attenuator on
	INU INK INW INO	2m RX: 0 dB, attenuator on
		N/10 = P in watts, power output 2m TX
3	IAS IAD IAR IAG	15m RX: 10 dB, attenuator on
	IAU IAK IAW IAO	15m RX: 0 dB attenuator on
		N/10 = P in watts, power output 10m TX
4	IMS IMD IMR IMG	15m uplink: off
	IMU IMK IMW IMO	15m uplink: on
		N/5 = V in volts, 15m RX-AGC volts
5	NIS NID NIR NIG	2m RX: off
	NIU NIK NIW NIO	2m RX: on
		N/5 = V in volts, 2m RX-AGC voltage
6	NNS NND NNR NNG	Special command station channel: off
	NNU NNK NNW NNO	Special command station channel: on
		N/5 = V in volts, special command AGC V
7	NAS NAD NAR NAG	Output power 10m beacon no. 1: max
	NAU NAK NAW NAO	Output power 10m beacon no. 1:min
		N/3 = (service command parameter)
8	NMS NMD NMR NMG	Output power 10m beacon no. 2: max
	NMU NMK NMW NMO	Output power 10m beacon no. 2:min
		N/3 = (service command parameter)
9	AIS AID AIR AIG	Status of first memory board: off
	AIU AIK AIW AIO	Status of first memory board: on
		N–10 = T in degrees C, 10m TX
10	ANS AND ANR ANG	Status of second memory board: off
	ANU ANK ANW ANO	Status of second memory board: on
		N–10 = T in degrees C 2m TX
11	AAS AAD AAR AAG	There is information in memory no. 1
	AAU AAK AAW AAO	. . . . . no information in memory no. 1
		N–10 = T in degrees C, 20V power supply
12	AMS AMD AMR AMG	There is information in memory no. 2
	AMU AMK AMW AMO	. . . . no information in memory no. 2
		N–10 = T in degree C, 9V power supply
13	MIS MID MIR MIG	Memory data send via beacon 2
	MIU MIK MIW MIO	Memory data send via beacon 1
		N/5 = V in volts, 9V pwr. supply control
14	MNS MND MNR MNG	15m ROBOT RX attenuator: –10 dB
	MNU MNK MNW MNO	15m ROBOT RX attenuator: 0 dB
		N/5 = V in volts, 15m ROBOT RX AGC voltage
15	MAS MAD MAR MAG	2m ROBOT RX attenuator: –10 dB
	MAU MAK MAW MAO	2m ROBOT RX attenuator: 0 dB
		N/5 = V in volts, 2m ROBOT RX AGC voltage
16	MMS MMD MMR MMG	Output pwr. special CMD channel: Max
	MMU MMK MMW MMO	Output pwr. special CMD channel: Min
		N = 00: Less than 32 SOs in ROBOT log
		N = 80 to 99: Over 32 QSOs in ROBOT log

Table 1. RS-12/13 telemetry data conversion. Keep this as a data sheet for your RS-12 and 13 telemetry calculations and findings. This information is provided by Pat Gowen G3IOR, with acknowledgements to RS3A, the RS Satellite Command Station, as source and to PA0DLO for relaying information.

will coolly ignore you if your Morse CW is not perfect. It will respond to your call at any speed between 8 and 50 wpm, give you a serialized QSO number, say who it is, and wish you 73 before it signs off with you to call CQ again. If QRM is present, it will tell you so. If you send too fast for it (an unlikely occurrence!) it will say "QRQ"; if you are too slow it will say "QRS," at least until it has matched your speed. "QRZ" or "RPT" will evolve if it is unsure of your callsign. The ROBOT calling frequency is 21.1297 MHz ± only 0.45 kHz Doppler shift, and as it is 3.2 kHz wide, gives no access problem. Fifty watts ERP at high angle passes, particularly at night when the high 21 MHz attenuation of the "E" layer is not manifested, will enter it readily by calling "**RS12 de G3XXX AR**" (use your own call, of course) after it has sent its CQ call. The 10m ROBOT downlink Doppler shifts from 29.4549 to 29.4535 MHz. When activated, the 2m ROBOT

Radio Sputnik 12 (RS-12)	
Beacon/ROBOT	29.408 MHz (CW)
Beacon/ROBOT	29.454 MHz (CW)
Mode A Uplink	145.910–145.950 MHz (SSB, CW)
Mode A Downlink	29.411–29.451 MHz (SSB, CW)
ROBOT A Uplink	145.831 MHz (CW)
ROBOT A Downlink	29.408 or 29.454 MHz (CW)
Beacon/ROBOT	29.408 MHz (CW)
Beacon/ROBOT	29.454 MHz (CW)
Mode K Uplink	21.210–21.250 MHz (SSB, CW)
Mode K Downlink	29.411–29.451 MHz (SSB, CW)
ROBOT K Uplink	21.130 MHz (CW)
ROBOT K Downlink	29.408 or 29.454 MHz (CW)
Beacon/ROBOT	145.913 MHz (CW)
Beacon/ROBOT	145.959 MHz (CW)
Mode T Uplink	21.210–21.250 MHz (SSB, CW)
Mode T Downlink	145.917–145.956 MHz (SSB, CW)
ROBOT T Uplink	21.130 MHz (CW)
ROBOT T Downlink	145.913 or 145.959 MHz (CW)
Radio Sputnik 13 (RS-13)	
Beacon/ROBOT	29.458 MHz (CW)
Beacon/ROBOT	29.504 MHz (CW)
Mode A Uplink	145.960–146.000 MHz (SSB, CW)
Mode A Downlink	29.460–29.500 MHz (SSB, CW)
ROBOT A Uplink	145.840 MHz (CW)
ROBOT A Downlink	29.458 or 29.504 MHz (CW)
Beacon/ROBOT	29.458 MHz (CW)
Beacon/ROBOT	29.504 MHz (CW)
Mode K Uplink	21.260–21.300 MHz (SSB, CW)
Mode K Downlink	29.460–29.500 MHz (SSB, CW)
ROBOT K Uplink	21.138 MHZ (CW)
ROBOT K Downlink	29.458 or 29.504 MHz (CW)
Beacon/ROBOT	145.862 MHz (CW)
Beacon/ROBOT	145.908 MHz (CW)
Mode T Uplink	21.260–21.300 MHz (SSB, CW)
Mode T Downlink	145.960–146.000 MHz (SSB, CW)
ROBOT T Uplink	21.138 MHz (CW)
ROBOT T Downlink	145.862 or 145.908 MHz (CW)

Table 2. Frequencies for RS-12/13. All frequencies are nominal, to the nearest kHz.

downlink goes from 145.9627 to 145.9563 MHz in an overhead pass. You will hear your own signal calling the ROBOT coming back to you as well as the response, but be warned! If you use this as your monitor, because the transit delay of the 4,000 mile maximum dual path slightly delays the return you are hearing of your own CW, it may affect your otherwise excellent Morse code! When the ROBOT is not activated for QSOs, e.g. it is not calling "CQ" at regular intervals, it may be employed as a single channel CW-only transponder.

The Channel 16 telemetry tells some of the ROBOT story. If the number sent is 00, then there are less than 32 QSOs in the ROBOT log, but if it is between 80 and 99, it is approaching capacity, as over 32 QSOs are in the log memory. You may hear digital downlink on the channel at times when RS-12 is within range of RS3A in Moscow. This is normally the log being downloaded.

Transponders

RS-12 is the system normally found on, with its sister RS-13 kept on reserve standby. The frequencies of both RS-12 and RS-13 are given in Table 2. We shall refer to RS-12, but what is given for this is also true for the alternate transponder, with only the frequencies differing.

The RS-12 Mode "K" transponder input running from 21.210 to 21.250 MHz will give a 29.411 to 29.451 MHz proportional linear return, with only some 0.9 kHz of combined Doppler shift. When active on mode "T" or "KT," it also has a downlink from 145.9167 to 145.9556 MHz, with an additive 21 and 145 MHz Doppler shift of ±3.5 kHz. If you add 124.7067 to your 21 MHz uplink, you will have (±3.5 kHz) the appropriate 2m downlink frequency. Similarly, when you add 8.201 MHz to your 21 MHz uplink, you have the downlink frequency upon which you will be present. When you move up by, say, 2 kHz on the uplink, you will also move up 2 kHz on both downlinks, as confirmed by monitoring. The total passband, given as 40 kHz, is in fact much wider, and can be heard over at least 70 kHz, e.g. 15 kHz either side of the stated band edge, albeit at reduced sensitivity and output efficiency.

In-Band Operation

As with our HF bands, the lower half of the transponder passband is for CW, the higher for SSB, with mixed modes in the center, just like our other satellites. To operate, just find a clear downlink frequency, and check that the relative uplink is clear too, as other terrestrial users may be in the uplink passband on 21 MHz. Adjust your transmitter to the appropriate calculated uplink, and you should hear your own transponded signal. Try a "CQ RS 12" or alternatively reply to another's CQ by adjusting your transmitter uplink to emerge on that frequency. You will be pleasantly surprised at who you will work on what might otherwise be a dead band. If you have a single transceiver, you may have "QSK," a rapid break in system, and hear the tail end of your transponded signal especially when the satellite is at maximum range and hence maximum return signal delay time. If you are blessed with a separate 29 MHz receiver then, aided by high-pass filters on the input to stop your 21 MHz breakthrough, you should be able to hear your own signal.

When and Where

RS-12 makes eight passes a day in range of most countries of average latitude, each pass lasting from only a few minutes to up to 19 minutes. Some skim the horizon, some go right overhead. Sub-horizon passes add considerably to useful opportunities, and in equinoxial high solar flux times the downlink may be heard and accessed for 70% of the day. To calculate the timing and exact passes, a computer program or an OSCARlator is desirable, both of which are available from AMSAT. The computer program or tracker will give you the satellite distance, azimuth, elevation, probably the Doppler shift, the range, and all you need to know to find the satellite. *Continued on page 38*

73 Review

by Bill Clarke WA4BLC

The JPS NF-60 DSP Notch Filter

JPS Communications, Inc.
5516 Old Wake Forest Road
P.O. Box 97757
Raleigh NC 27624.
Price class (introductory): $150.
Adapter: $12.
Tel. (800) 533-3819.
Technical info: (919) 790-1048.
FAX: (919) 790-1456.

Get rid of multiple carriers with the push of a button.

Notch filter—that's the knob you madly twist when trying to block out an interfering signal such as a tuner-upper or a heterodyne. The down side of using the typical notch filter is that most of them are overly sensitive and clumsy to tune, thereby making them slow to use. In fact, the offending signal often disappears before you can notch it out.

Although the technology of notch filters has advanced over the past several years to the point that even 40 meters becomes usable during the night hours, they are still perplexing to use. But now, enter the automatic notch filter.

The automatic notch filter does all the work of its manual cousin, except that it requires no knob twisting. It locates and removes the offending signal instantaneously; the operator doesn't have to do anything to make the filter work except turn it on. New to the market is just such a filter, the NF-60 DSP Notch Filter by JPS Communications, Inc.

First Impressions

The NF-60 is manufactured right here in the U.S. Smaller than most handhelds and weighing enough to remind you that quality can be felt, the NF-60 is black and has only two controls: Power on/off and Notch on/off. On the rear panel are two RCA jacks for Audio (in/out), and a power jack for the AC adapter line.

The manual is very professionally done, yet easy to understand, and contains installation diagrams, explanations of operation, and theory.

Installation

Installing the NF-60 is about as simple as hooking up an external speaker, which, by the way, is essential for use of the filter. Plug the (optional) AC adapter's output line into the power jack on the rear panel of the unit. Run an audio patch line (I recommend shielded) from the Audio Input jack to the external speaker jack of your rig, and plug an external speaker into the unit's Audio Output jack. That's all there is to it!

Just in case a polarity mistake is made, you don't need to worry. The NF-60 is reverse polarity protected.

Operating with the Filter

As an initial check of the NF-60, I turned on my HF rig as normal and set it to the Canadian time clock on 7.335 MHz (and later the U.S. time clock at 15 MHz) on LSB, and tuned until I heard a steady tone. I then pushed the NF-60's Power and Notch buttons to "on" and the tone immediately went away. I tuned around the time clock to see if the tone (or any tone) could be heard again, while leaving the NF-60 on. The most I ever heard was a split second of tone before the automatic notch locked up and took it away.

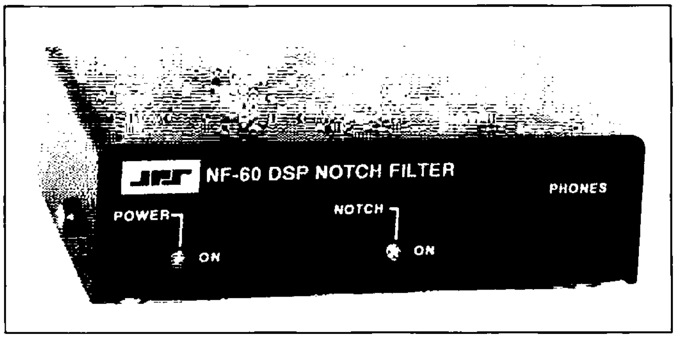


Photo A. JPS's new NF-60 Notch Filter.

Having proved that the NF-60 could take out tones of a very loud and steady nature, I then went to the real world of the ham bands. Of course, I left the NF-60 on. At first I thought there were no tuner-uppers around on the various 80/40/20 meter nets I tuned to. Then I turned the filter off and found the offenders were alive and well. I continued to tune around and turn the filter on and off, seeing what it could do. I even verified the claim that multiple tones could be notched out simultaneously.

The filter only notches a small segment of the audio spectrum out, so small that it doesn't destroy the quality of the remaining signal. Unless the filter was turned off, I generally never even knew the offending signals existed. The single exception to this rule was when the offending signal was strong enough to work the receiver's AGC. This caused a slight audio level reduction.

The NF-60 makes 40 meters useful at night. You can get in between those broadcasters, and their carrier tones just disappear, allowing SSB to carry on.

Although I have been using automatic notch filters for years, I must say that, due to the fast lock-up time, excellent audio quality, and multi-frequency ability, the NF-60 is the best I have heard.

Comments

The NF-60 operates on a digital signal processing scheme, and constantly looks at the audio spectrum for solid tones. When a tone is encountered, the unit immediately creates a very narrow and deep notch at that frequency, removing the tone.

As mentioned above, the NF-60 is capable of taking multiple tones out. For example, the typical RTTY signal is reduced to a series of

Specifications

Audio Input:	unbalanced low impedance 22 ohms or 47k ohms; (phone jack)
Frequency Response:	250 to 3400 Hz ±2dB
Input Level:	100 mV to 2V rms
Output Delay:	0 milliseconds
Lock-up Time:	<6 milliseconds
Ultimate Tone Rejection:	>50 dB (1 to 4 tones) (slightly lower for 5 or more tones)
Audio Distortion:	<.5% at 1 kHz at .5W output
Headphone Output:	8 ohm or greater (stereo phone jack)
Speaker Output:	2W at 10% distortion into 8 ohm speaker (RCA jack)
Front Panel:	power switch, power LED, notch switch, notch LED
Rear Panel:	audio input, audio output, DC power input
Input Power:	+11 to +15 VDC at 250 mA (750 mA peak)
Dimensions:	1.7" x 6" x 4.3" HWD at 2 lbs.

clicks, without tones.

With the filter turned on, you will find that CW sounds like an old Western Union telegraph sounder's clickity clack!

The filter has a built-in audio amplifier. For normal listening levels it is very satisfactory. However, it can be driven into distortion by running the receiver's audio gain too high. I found this to be no practical limitation, as it only occurs at very high levels that drove me from the shack anyway.

It appears that the NF-60 is not susceptible to RF interference (some audio filters are). This was carefully checked on all bands using full legal limit power.

The lock-up time of the NF-60 is very fast. In fact, I found it is capable of following slow swishers.

I did find a very slight clicking sound to be mixed in with the normal output audio. I am not concerned about this, as I had to really listen closely to even hear it.

The front panel phone jack is a positive feature.

The only feature missing is an indicator (such as an LED) showing when the filter is earning its keep.

Technical Aspects

The NF-60 uses digital signal processing to find and notch out offending tones. The internal workings of the unit include a TMS320P15 DSP chip which does all the work, except for A to D and D to A conversion (which is handled by a 14-bit converter). The chip operates at 20 MHz (crystal-controlled).

When feeding the receiver modulated signals (tones), I found there was no real limit to what the NF-60 could notch out. A 60 dB over S9 signal could be eliminated (not just reduced). I also found the filter worked at very low audio settings, even at settings where the tone was barely audible. Both factors exceed specifications.

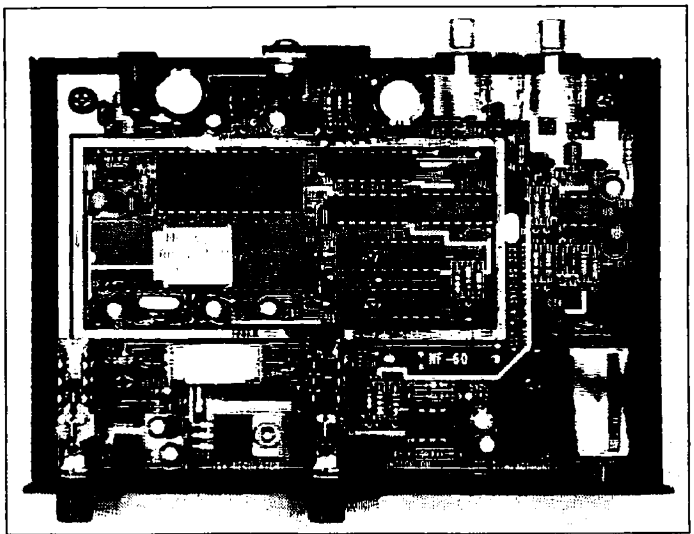


Photo B. Inside view of the filter showing the DSP circuitry.

The weight of the unit is such that the push-button switches can be worked without having to chase it all over the desk.

The simplicity of operation is excellent. Turn it on and forget it. It does its job by itself.

Recommendation

I feel the NF-60 is a piece of ham equipment that does its job completely and simply. The sheer pleasure of not hearing tuner-uppers, and being able to use 40m at night between all those foreign broadcasters, is worth the reasonable cost of the NF-60. I heartily recommend that every SSB operator own one of these neat little filters (the NF-60 is only for SSB).

The NF-60 does the job it is supposed to do one hundred percent.

For a number of years I have been hollering that automatic notch filters are the greatest thing since sliced bread. You transceiver and receiver manufacturers out there: Remember how I have been saying you should include automatic notch filters in your rigs? Well, forget it! This new filter is so good I doubt you could beat it for quality or price. 73

Using RS-12

Continued from page 35

If you join the Sunday 1730 UTC 14.282 MHz pre-AMSAT Net warm-up session, the 14.280 MHz Saturday 1000 UTC European AMSAT Net, or the 75 meter AMSAT Net on 3.840 MHz (Tuesday evening at 9 p.m. local time—i.e. Wednesday at 0200 UTC), regular satellite operators will be happy to provide you with pass times and intervals for your location.

Station Needs

For the transmitter, just 50 watts to a simple dipole or ground plane will suffice, although a beam and 100 watts will perform far better for those low angle and sub-horizon times. While G3IOR uses a 21/28 MHz three-element beam at 65 feet, G2UK runs a simple 75m trap dipole only 10 feet over the ground and gets not only excellent in-range results, but sub-horizon access also.

The receiver doesn't need to be anything special, but if you have a very old tube radio, then a 10m preamplifier will improve sensitivity performance considerably. A separate transmitter and receiver will help a lot, as you may then monitor your downlink while simultaneously transmitting on the uplink. If your band switching is fast enough and your frequency calibration accurate, a transceiver will suffice.

Problems

On the downlink you may hear many stations using the 21 MHz uplink passband for terrestrial style QSO, and be surprised by the comparison between what you can hear on the satellites downlink compared to that on the corresponding uplink. Try not to QRM any users who are already on the frequency, as this section of 21 MHz is not a space-specific subband, and they have every right to be there.

On the other hand, you may find severe QRM from wide FM signals in the satellite downlink passband under high MUF propagation conditions. These stations can cause severe wideband QRM to the weaker CW and SSB satellite transponded signals, and have no absolute right to be there as the satellite downlink band is recognized as being specific as a space band. A polite request for them to move back to the FM allocation below 29.400 or above 29.510 MHz will usually result in recognition. Sadly, with FM receivers, they may not even hear the signals from the satellite, and thus may well not be aware of their transgression.

Satellite DX and Propagation

In the first few days of operation, G3IOR worked 17 countries on RS-12, including W1, 2, 3, 5, 8, 9 and Ø; VE1, 2 and 3; UAØ, ZL, plus many European countries, including fellow "G" and European stations. You will find that at high solar flux times you can access and hear the return even when the satellite is up to 48 degrees below your horizon, especially at pre-auroral ionosphere enhancement times. You are hence able to work the whole world! You may be horrified to hear your return as a real "T-2" note sounding much like an auroral or even equatorial zone condition due to multi-Doppler paths. You will find it to be quite fascinating, and a means of working those 21 and 28 MHz inter-skip-zone fellow amateurs, as it will reach to the parts that other propagators will not reach! It is a source of superb ionospheric data and research to boot!

RS-12 is an ideal satellite for the HF operator, who will be able to continue to work DX even when the 21 and 28 MHz bands are otherwise dead, and to work both locals and inter-continental DX via the satellite while the bands are on the edge of the MUF, as the re-angulation, while insufficient for direct terrestrial QSO, is often adequate for the low satellite angular incidence to the ionized layers. It has the added advantage that the commercial and military intruders who tend to sneak into the high ends of our depleted amateur bands in the quiet sun years will discover amateur occupancy, and thus we may maintain our precious frequencies and help forestall further cuts. RS-12 is very user friendly and is recommended to HF DX operators, newcomers, those who "have done it all," plus old and new satellite fans! Will we see you on RS-12? 73

The author appears regularly on the given AMSAT nets, and would be pleased to respond to any questions arising. On Packet Radio, Pat is contactable as G3IOR @ GB7VLS. #35. GBR. EU.

40/80 Meter Wave Ryder

A QRP tube transmitter powered by 12 volts DC.

by Charles D. Rakes KI5AZ

If you've been looking for a new project to build that has a nostalgic quality mixed with a touch of today's technology, then look no farther because our 40/80 Meter Wave Ryder CW QRP transmitter offers these features and more.

The transmitter's circuit design is similar to the single tube crystal controlled QRP rigs that were in vogue during the fabulous '50s. A 3A4 miniature power amplifier pentode tube is connected in a crystal controlled tuned-plate oscillator circuit with a power output of 1 to 2 watts.

The circuitry's modern mix allows the transmitter to operate from a single 12-volt DC power source. A 7805 5-volt regulator IC is connected in a 100 mA constant current circuit that keeps the tube's filament glowing just right as long as the DC input stays above 8 volts.

The tube's B+ is generated on command, and to see how, take a look at the schematic diagram in Figure 1. A 555 IC timer is connected in an astablc oscillator circuit with C1, R1, R2 and R9, setting the operating frequency to about 25 kHz.

Q1 holds pin 5, of the IC, at ground level while the key is in the "up" position, keeping the 555 circuit from oscillating. The majority of the battery drain at standby, or during the time between dits and dahs, is the filament current.

Each time the key is closed, the 555 circuit becomes active, supplying base drive to the MJE 3055 power transistor. The power transistor's pulsing collector current turns the 12 volt supply into about 150 volts at the secondary of T1.

The full-wave bridge circuit converts T1's output to DC, and C4 smooths out any glitches. At key-down, the tube is supplied with almost instant B+, causing the circuit to oscillate and send out a CW signal.

Building the Wave Ryder

The circuit may be built breadboard style if you like, as long as the wiring is neat and the leads are kept short. Or you may take the easy route and use a PC board. If so, just follow the component placement layout shown in the

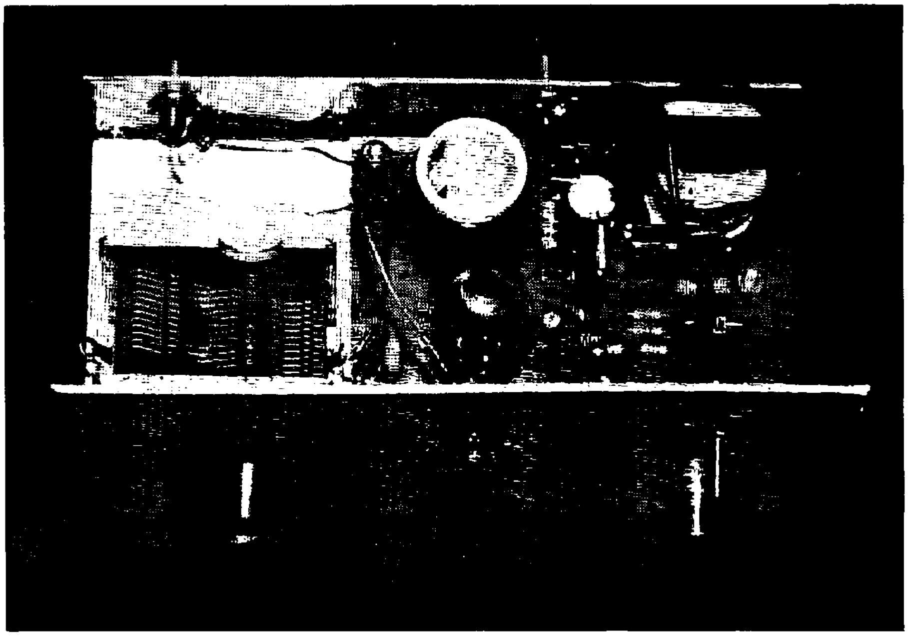


Photo A. The 40/80 Meter QRP CW Wave Ryder.

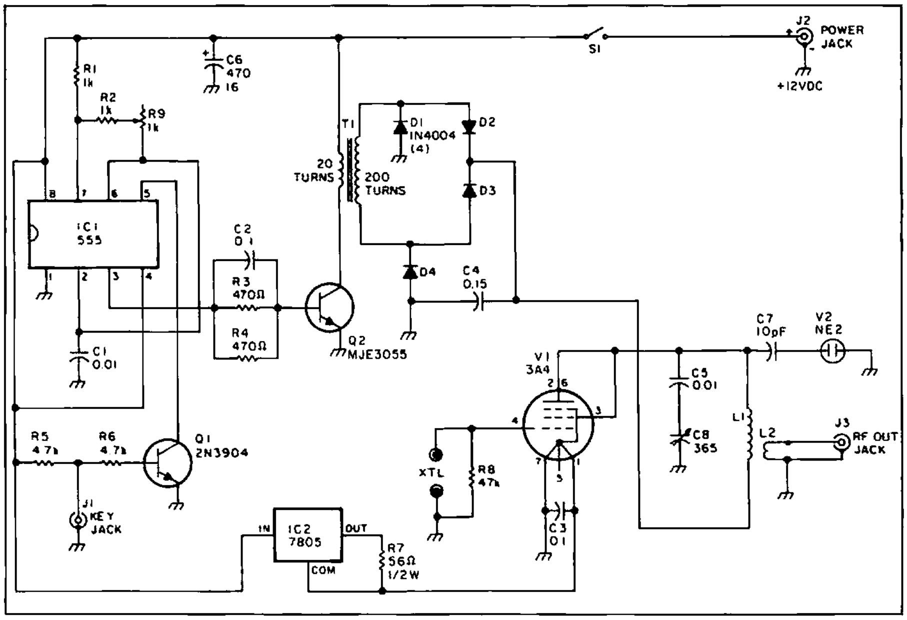


Figure 1. Schematic for the Wave Ryder.

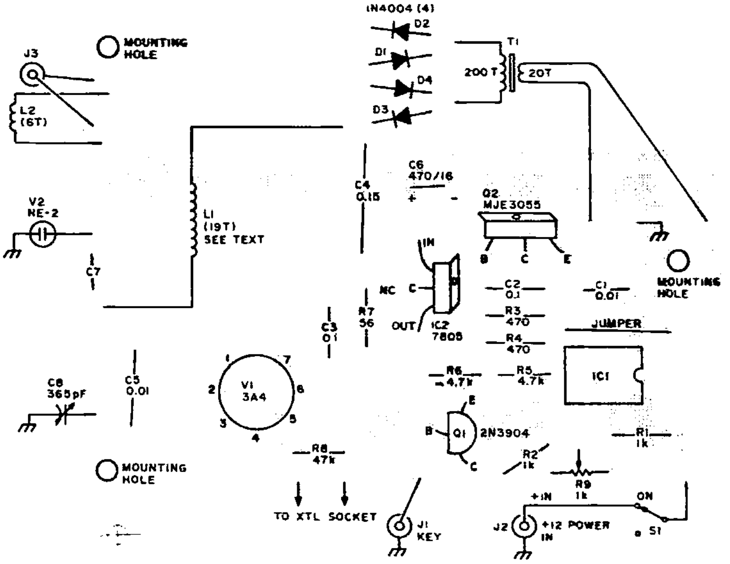


Figure 2. Parts layout diagram.

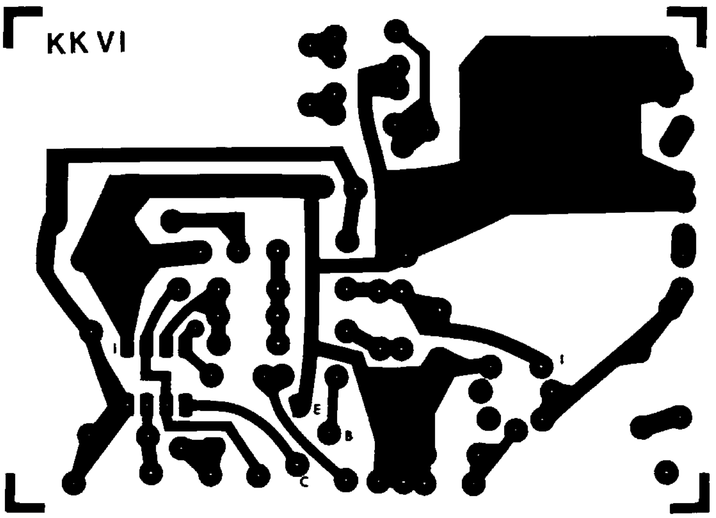


Figure 3. Foil diagram.

	Parts List	
C1	0.01 µF/100V	Mylar
C2,3	0.1 µF/50V	disc ceramic
C4	0.15 µF/250V	Mylar
C5	0.01 µF/630V	Mylar
C6	470 µF/16V	electrolytic
C7	10 pF/500V	disc ceramic
C8	365 pF variable	broadcast type
D1–4	1N4004 1 amp	silicon
IC1	555	timer
IC2	7805 5V	regulator
Q1	2N3904	transistor
Q2	MJE 3055 power	transistor
V1	3A4 miniature power amp	pentode tube
V2	NE-2 or similar	neon lamp
R1,2	1k 1/4W	resistor
R3,4	470 ohm	resistor
R5,6	4.7k	resistor
R7	56 ohm 1/2W	resistor
R8	47k 1/4W	resistor
R9	1k trim pot	single turn
J1–3	RCA jacks	phono
S1	Small switch	toggle on/off
T1	EA-77-375 core and bobbin	Amidon*
L1,2	see text	
Misc.	Chassis, circuit board, knob, grommet, crystal socket, hardware, wire, etc.	

*Amidon Associates, Inc., 2216 East Gladwick St., Dominguez Hills CA 90220. Tel. (213) 763–5770.

You can get a kit of parts for the Wave Ryder, including the circuit board and all components that mount on it and parts for T1 (less winding wire), a coil form, and five socket contacts, all for $24.95 postpaid, from Krystal Kits, P.O. Box 445, Bentonville AR 72712, or call (501) 273–5340 and ask for KI5AZ.

You will have to furnish the chassis, tuning capacitor, neon lamp, grommet, power switch, crystal socket, jacks, tube, wire and hardware to complete your TX. A PC board only is available for $7.95 postpaid, and five Concord socket contacts are available for $3.00 postpaid.

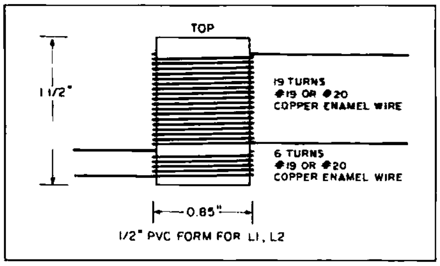


Figure 4. A piece of 1/2" PVC pipe serves as the coil form for L1 and L2.

PC foil pattern drawing in Figure 2, and stuff the parts on the board. The tube socket is made up of five Concord #09-9006 socket pins (cost of five is less than two bucks) soldered in place on the circuit board. But you can also use a regular tube socket and wire it to the circuit board with short leads.

Winding T1

The transformer's two windings are wound on the nylon bobbin supplied with the Amidon EA-77-375 "E" core. Wind 20 turns of #26 copper enamel wire in a solenoid fashion on the bobbin. On both windings, leave at least three inches of wire at each end to connect to the circuit board. Place a layer of plastic tape around the winding to complete the primary. On top of the primary winding, wind 200 turns of #26 copper wire for the secondary and tape in place. Place the bobbin between the two cores and tape or glue in place.

Winding L1/L2

The tank circuit is wound on a 1-1/2" length of 1/2" PVC cold water pipe that actually measures 0.85" in diameter. Just about any hardware or plumbing shop will have the PVC pipe on hand.

Refer to Figure 4, and close wind 19 turns of #19 or #20 copper enamel wire on the form for L1. Space down the form about the width of two turns, and wind 6 turns of the same size wire for L2. An easy way to keep the windings in place and looking neat is to drill two wire size holes for each wire end, and fish through for a snug fit.

Making the Chassis

Since cabinets are so expensive and difficult to find, the Wave Ryder was constructed on a piece of 0.05-inch thick aluminum cut to 7" x 5-3/4". To duplicate our Wave Ryder, just follow the drawing in Figure 5.

J1, the crystal socket, S1, and the neon lamp, all mount to the front panel. The neon lamp is placed in the middle of a chassis mount rubber grommet with one lead going to the circuit board, and the other to circuit ground under the grommet's lip. The tuning capacitor and circuit board are mounted to the chassis' bottom, and the two remaining jacks are located on the back lip.

Making Waves

Connect power, a dummy load, a crystal, and close the key. Start with C8 at maximum capacitance and rotate clockwise until V2 lights. Tune a receiver to your crystal's frequency, and send a few dits. Slowly rotate C8 clockwise until a clean, chirp-free tone is heard. With R9 set at its maximum resistance, the B+ voltage will be at its minimum with an RF power output slightly under one watt and at its minimum resistance the B+ will be at its maximum with an output of over one watt. If Murphy didn't make an untimely visit to your shack, you should now be ready to make waves. *Continued on page 46*

Charles D. Rakes KI5AZ, P.O. Box 445, Bentonville AR 72712.

A Remote Field Strength Meter

An accurate system for measuring radiated power.

by Ken Cornell W2IMB

Are you sure that you are obtaining the best radiating power from your antenna? Most radio hams rely on their antenna tuning units and SWR bridge, as well as on-the-air reports. Yet there's always the feeling that it could be improved.

Most hams are familiar with the field strength meter. The meter usually consists of a tuned L/C circuit with a whip antenna, and uses a diode to register the relative field strength of the received signal on a sensitive microammeter.

FSMs are valuable for tuning up transmitters, but to accurately measure the relative strength of a transmitted signal, the FSM should not be used inside the shack, close to the transmitter and antenna tuning unit. Instead, it should be used several wavelengths distant from the transmitter's antenna.

This can create a problem, as two people would be required, one at the transmitter site and the other at the remote field strength meter location. Plus, the two parties would need to be able to communicate with each other.

The Remote FSM

The scheme I am about to describe would require only one person. A remote field strength meter is used to send a signal back to the transmitter site. The FSM is capable of indicating maximum radiated power as the transmitter and antenna tuning units are adjusted.

The remote FSM works with an FCC Part 15 transmitter (no license requirements) that operates in the 510 to 1705 kHz spectrum. The FCC rules permit maximum input power of 100 mW and an antenna 2 meters long. At 300 to 400 feet, the transmitter should put a good signal into a station receiver.

See Figure 1 for a block diagram of the system.

Figure 2, the FCC Part 15 transmitter, consists of a Hartley VFO with a buffer and final amplifier. I built the circuit on a 2-1/2" x 5" piece of perfboard that in turn was mounted on a block of wood on standoffs. My transmitters include the 1500 to 2000 kHz range, so I used a target frequency of 1650 kHz for the FSM transmitter.

I wound L1 on a 5/16" diameter slug tuned

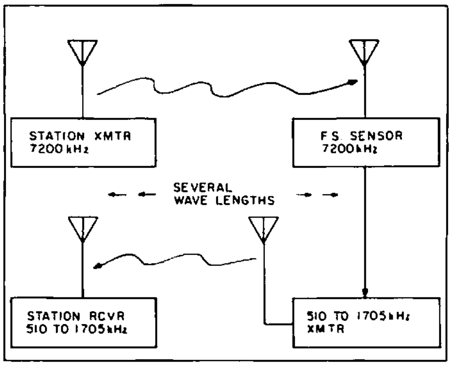


Figure 1. Block diagram of the remote field strength meter.

form with 100 turns of #28 enameled wire, with the source tap at 25 turns from the ground end. Coils L2 and L3 were wound on a length of hardwood dowel 1/2" in diameter, each with 100 turns of #28 wire. For L4, I wrapped a turn of Mylar tape around the ground end of L2, and wound 15 turns of #28 wire with taps at 5 and 10 turns. I use the tap that offers best performance.

The varactor (V) is placed across L1 in series with the 0.1 µF blocking capacitor. The F.S. sensor, shown in Figure 2, receives the transmitted signal and rectifies it and the rectified voltage is applied to the varactor circuit through the RF choke.

With no applied voltage, the varactor offers maximum capacity to the tuned circuit. As voltage is applied, the capacity will diminish. Therefore, when used in a VFO tuned circuit, the higher the applied voltage, the higher the frequency.

The F.S. Sensor's transmitted signal is tuned in on the station's receiver, and as the station's transmitter is tuned up to its antenna, the F.S. Sensor will detect this transmitted power; and as the resultant voltage is applied to the F.S. Sensor's transmitter, the frequency will rise. This beat-note will be detected on the station receiver, and the tune-up procedure is continued for maximum beat-note swing. This beat-note swing can be either way, depending on which sideband is used.

This could be an effective way for tuning up a beam antenna. A portable transistor radio can be used, and the F.S. Sensor's transmitter can be tuned to heterodyne a B.C. station, then tune the beam for maximum frequency swing.

Continued on page 46

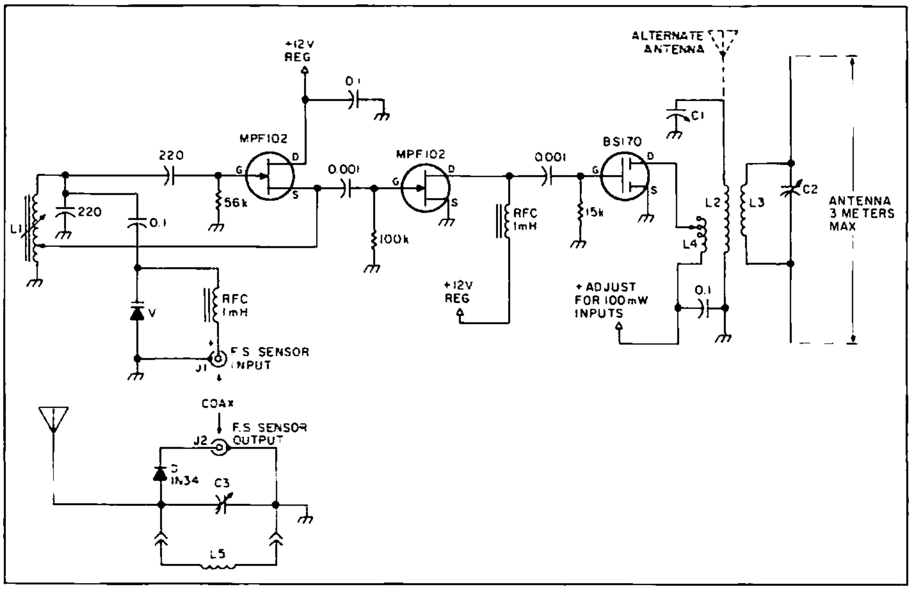


Figure 2. Schematic diagram of the remote field strength sensor and transmitter.

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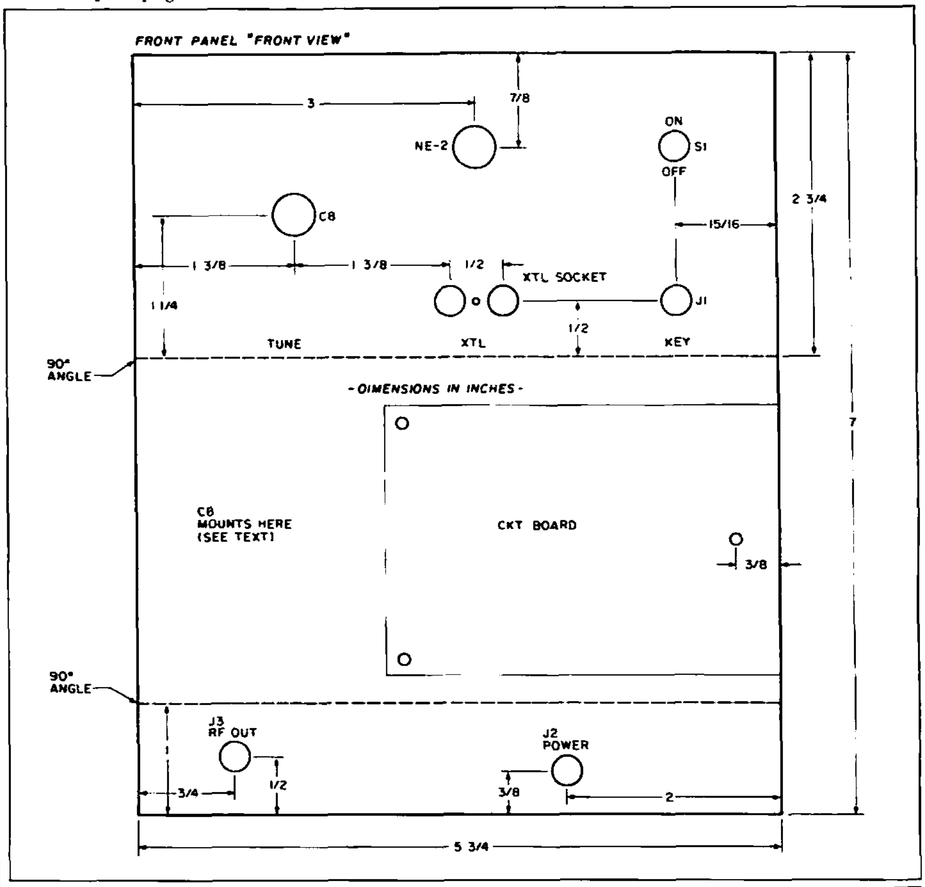


Figure 5. Chassis design and placement of lights and controls.

Field Strength Meter

Continued from page 44

The doublet antenna arrangement I show in Figure 2 is the scheme I use, but an antenna can be connected to the junction of C1 and L2. The FCC rules state that any length of ground return has to be included in the antenna length (three meters).

Any antenna length for the F.S. sensor can be used, and I suggest that the best ground available be used.

For convenience the two units (the sensor and transmitter) do not have to be closely associated, and the units can be separated as desired yet be connected with coax cable via the jacks J1 and J2.

For power, I use two 6 volt lantern batteries connected in series with 12 volts applied to the VFO and buffer. Six volts is taken off for the final amplifier.

I obtained my varactors from DC Electronics, P.O. Box 3203, Scottdale AZ 85271. I ordered a supply of various types, and the MMV2109 is the one I happened to use.

The BS170 (Amperex) and the BS170P (Zetex), both MOSFETs, are fine performers. They are available from Digi-Key Corp., P.O. Box 677, Thief River Falls MN 56701. The BS170 is on page 57, and the BS170P on page 58, in their July–August '91 catalog. ■

Parts List

Q1,Q2	MPF102 FET
Q3	BS170 MOSFET
L1–L4	See text
L5	See Table 1
C1,C2	90 to 420 pF mica trimmers (RS# 272-1336)
C3	150 pF variable capacitor
C4,C5	220 pF
C6,C7,C10	0.1 µF
C8,C9	0.001 µF
R1	56k resistor
R2	100k
R3	15k
D1	MV2109 varactor diode or equivalent
D2	1N34A germanium diode

Table 1. Field Strength Coil Details

Band	Turns
160m	120 turns closewound
80m	50 turns closewound
40m	20 turns closewound
20m	10 turns spaced one wire diameter apart
10 & 15m	6 turns spaced over a ½ inch length

Use #30 enameled wire.

Ken Cornell (ARS W2IMB), 225 Baltimore Avenue, Point Pleasant Beach NJ 08742.

Number 25 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

Microwave—A Black Box Technology

How is microwave activity doing in your part of the country? Having trouble getting other amateurs out of the woodwork and interested in microwave communications? Is microwave limited to line-of-sight (LOS) communications? What benefits do microwave communications offer? And the big question: Why do we enjoy microwave operations? These and other questions always come up when talking to other amateurs who are trying to understand what we do. I thought I would take time to reflect on just what promotes interest in microwave communications.

Trying to answer these questions and keep on track requires a little tightrope walking. Most communications are portable, not hamshack to hamshack. While there are stations that communicate from home QTH via microwave on a scheduled basis, this is not the norm. Microwave communications is carried out on a prearranged schedule or during the ARRL 10 GHz contest weekends.

Time in the shack is mostly spent in constructing new devices, making improvements to an existing transverter, or experimenting. Most of the items needed have to be constructed, as ready-to-use items are just not available at modest prices. Needless to say, the construction phase is what interests me the most.

Getting Others Involved

Now, how do you interest other amateurs in microwave communications? A few of us were successful in cultivating interest by setting up a working microwave demonstration at our local swap meet. This demo proved to be the catalyst that started the San Diego Microwave Group. We formed a varied interest forum to discuss applications and share ideas. Getting others interested in microwave could be just as simple in your part of the country. Try setting up a station at your local swap meet or hamfest. This usually brings out lots of interested parties. Be prepared for questions. Keep your presentation basic, like a wideband FM link.

The Benefits

What benefits can be derived from microwave communications? If you don't have the pioneer spirit driving you to something new, you might as well use the telephone. It's a lot easier. I catch it from my wife on this one; with excellent results on 2 meters, why do we shift to microwave and all its troubles? Well, if you want to try something new, are interested in construction and outdoor activities, and not just "lunch box operation," microwave has a lot to offer. The new construction techniques increase your knowledge of electronics. Instead of operating someone else's equipment, try building your own. Your radio might not look as good as a commercial unit (mine never did), but you will have lots of fun constructing it. The personal enjoyment I get from home-brewing projects always make me feel quite rewarded.

Answering questions from readers makes me dig deeper into the subject matter, and teaches me new things. It expands my general knowledge, provides me with ideas to develop, and challenges me to improve operations. It's like a game of chess with myself. Now don't take me for anything but a tinkerer and experimenter, one who is glad to share the information gleaned from varied subjects. The deeper I dig for information, and the more ways I find to remove the "black magic" cloak of microwave operations, is reward enough for me.

The Myth of LOS

It is commonly believed that microwave is limited to line of sight communications. Nothing can be farther from the truth! In fact, microwave communications can be regularly carried out on nonlinear paths. Many more contacts occur through scatter and tropospheric ducting than LOS paths. Contacts of several hundred miles and further are standard. Contacts have been made via moonbounce on all the microwave bands up to 10 GHz—that's line of sight, but what I want to point out is that short distance (LOS) is not the limiting factor for microwave communications.

No Comparison

Comparing microwave to VHF operation in my mind is not valid. Today's radios are computerized, with many intricate features. You just don't pick up one of these radios and operate it; you must read the manual first. Personally, I like what VHF operation has evolved into, and I enjoy operating the high tech radios. What is missing for me is that old back-to-basics construction program that promotes interest through application of building techniques. A direct benefit of microwave operation is the knowledge gained through the effort of construction.

On our lower frequencies, such as 3/4 meters (450 MHz), video and SSB weak signal work is quite exciting. Several manufacturers have quite a line of video equipment to operate on these bands. Equipment such as Tom W6ORG's PC Electronics line of video transmitters and receivers help fill a gap in equipment availability for these frequencies. This is just one of many aspects of microwave operation for the 450 and 1296 MHz frequencies. Weak signal SSB/CW work is being carried out on the same bands, and impressive distances have been recorded for DX contacts.

On the frequencies of 2304 MHz and up, SSB and CW contacts have been accomplished from Hawaii to the California coast. This is not the only long distance work that was done, but it's representative of distances covered on one such contact. Many other amateurs have confirmed impressive long-haul contacts. Such contacts necessitate a shift from wideband FM to narrow band operation, usually SSB or CW.

Microwave Narrow Band Operation

There is much to gain in signal-to-noise ratio advantage by a reduction of bandwidth. This one fact has led a change to SSB for microwave communications. SSB microwave equipment is more costly but far more efficient than WBFM. The frequency stability problem is all but eliminated when using the phase-locked brick oscillators for SSB or CW. For instance, in the last ARRL 10 GHz contest, all 39 contacts made by my station were SSB. I do not plan to abandon WBFM, but rather advance to a different mode of operation.

With the shift to SSB and narrow band operation, the establishment of microwave communication from home QTHs is more likely. With these improved methods, narrow bandwidths, and higher transmitter powers available from both solid state and TWT type amplifiers (available in surplus), home microwave operation is now possible.

Scatter

One example is the station that I currently have on 10 GHz, which can be operated from my home QTH. No, I don't crawl up on the roof for contacts, but rather have an unobtrusive two-foot dish with a flexible and strong

Continued on page 82

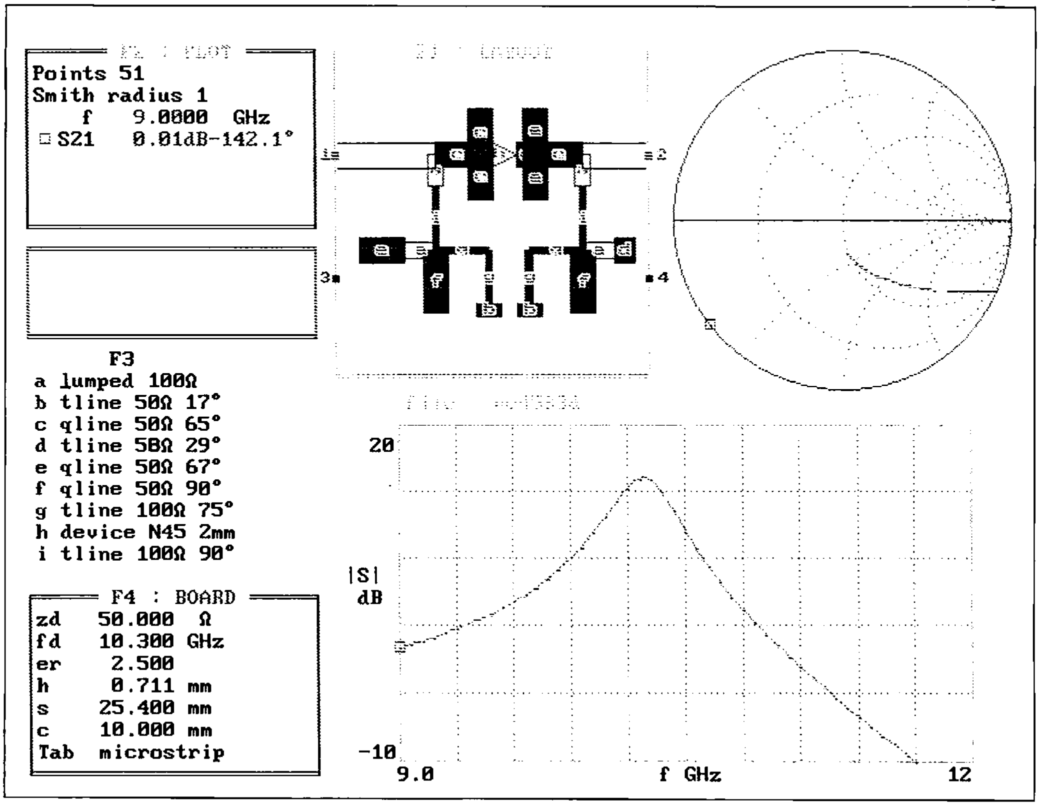


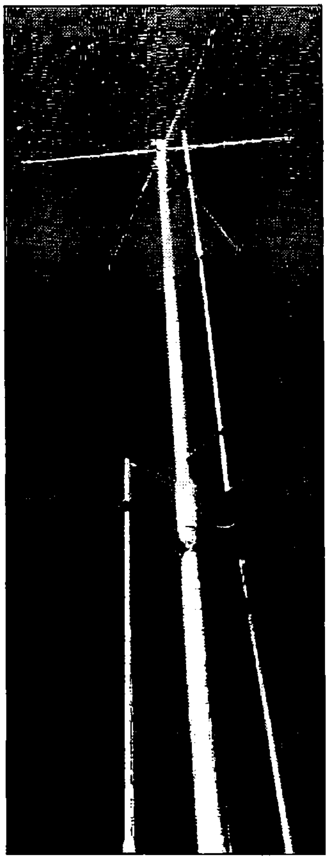
Figure 1. PUFF screen dump of file NE4583D. Smith chart, top right. Frequency vs. gain plot, bottom right. Components used in layout window all stripline. Example F = 50 ohm stripline (90 degrees), 1/4-wavelength long.

Number 11 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

GAP ANTENNA



GAP Antenna Products has introduced the Voyager DX-IV, a unique multiband vertical antenna that uses the same GAP technology found in the Challenger DX-VI. The Voyager DX-IV is the first vertical designed primarily for low-band operation. It covers all of 20m, 40m, and 80m with a VSWR under 2:1; on 160m the bandwidth is 90 kHz under 2:1.

The Voyager is 45′ tall with an 80″ diameter capacity hat at the top, giving the antenna an effective electrical height of 66′. The antenna comes with a hinged base which simplifies installation. It requires two sets of guys which are attached to furnished guy clamps. The only other item required for operation is three 57′ counterpoise wires attached at the base of the antenna. These can be displayed in any fashion, which lends itself nicely to tight locations. The Voyager DX-IV weighs a manageable 30 pounds and can be assembled in an afternoon.

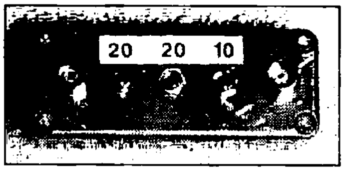
The antenna is available through the manufacturer for $389. For more information, contact *GAP Antenna Products Inc., 6010 Bldg. B, North Old Dixie Hwy., Vero Beach FL 32967; (407) 778-3728.* Or circle Reader Service No. 201.

THE QSL POST OFFICE

The QSL Post Office, a private QSL bureau, invites you to save money and mail your U.S.A. QSL cards for just 10 cents each. Send multiples of 10 QSL cards with a check, cash or money order. Do not put postage on the cards or place the cards in individual envelopes. For more information, contact *The QSL Post Office, 767 South Xenon Court #117, Lakewood CO 80228; (303) 987-9442.* Or circle Reader Service No. 206.

ELECTRON PROCESSING

Electron Processing has announced a new tool for everyone involved in the fun of transmitter hunting, the SGR-1 attenuator box, which reduces the signal received to a meterable level. This handy device lets you make accurate signal comparisons of strong signals and is also a simple tool to aid in receiver alignment. The SGR-1 is a three-section 50 ohm attentuator box that allows you to switch in or out up to 50 dB of attenuation in 10 dB increments. It features easy operation via three toggle switches. Compact and ruggedly constructed, it is ideal for hunting down interference sources. Connection is easy via the two female BNC connectors provided.



The SGR-1 is priced at $50, plus a $5 shipping/handling charge. Contact *Electron Processing, Inc., P.O. Box 68, Cedar MI 49621; (616) 228-7020.* Or circle Reader Service No. 205.

PROCOMM/BRAINSTORM ENGINEERING

Procomm, in conjunction with Brainstorm Engineering, has introduced the smallest frequency counter capable of measuring frequencies in excess of 1.3 GHz. The FC-1300 Micro Frequency counter has 0.2 µV sensitivity, 1 kHz resolution, and 0.01 PPM accuracy. The entire unit (3.25″ x 2.13″ x 1.13″) fits easily into a shirt pocket. The FC-1300 is ideal for verifying VFOs, netting crystals on frequency, determining the frequency of unknown transmission, and overall bench applications.

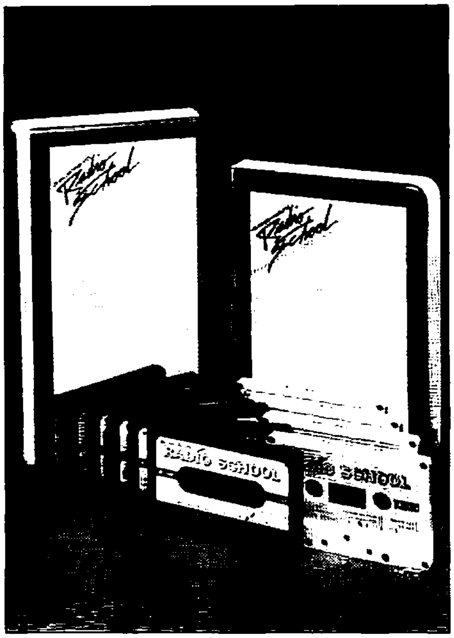
The introductory price is $69.99, battery included. For more information, contact *Procomm, 1948 Coventry Ct., Thousand Oaks CA 91362, (805) 497-2397; or Brainstorm Engineering, 2948½ Honolulu Ave., La Crescenta CA 91214, (818) 249-4383.* Or circle Reader Service No. 202.

DENNIS DITTO

R.L.S., Relational Logging System, is a professional all-band, all-mode QSO logging and reporting system for PC-compatible computers. Its features include extensive QSO data capture, advanced QSLing capabilities (cards, labels and more), on-line ham directory and a powerful reporting system. R.L.S. runs on 286 or higher PCs with 1 meg of RAM and a hard disk. It is backed by a full user support program.

The retail price is $69 in the continental U.S., $74 elsewhere. For more information, send an SASE to *Dennis Ditto N1DIZ, P.O. Box 52, Dover MA 02030.* Or circle Reader Service No. 204.

GORDON WEST



Gordon West's Radio School is offering a "Ham Class" video and "on the air" operating cassettes. The "Ham Class" video is produced for instructors and elmers to show how to organize an action-packed teaching program for amateur radio instruction. It takes instructors all the way through the steps of organizing an amateur radio class. Using it in a class will show students some of the very best ham class demonstrations put on by "Gordo." The audio cassettes explain how to use selected pieces of amateur radio equipment. Gordon takes the new dual-band and tri-band sets out of the box and, on tape, goes through the initial programming of all the memory channels on side one; side two covers the advanced features plus simple modifications.

For prices and more information, contact *Gordon West Radio School, 2414 College Dr., Costa Mesa CA 92626; (714) 549-5000.* Or circle Reader Service No. 207.

The Lappack

Extended portable power for your laptop computer.

by Brian Kassel W5VBO

The successful launch and orbiting of the Microsat series of satellites earlier this year ushered in an exciting new adjunct to the packet radio revolution. With their low orbits and powerful transmitters, the new birds can be worked with a comparatively simple station layout.

This realization led me to begin designing a portable Microsat station. The dream of uploading and downloading messages and bulletins from around the world while camping, vacationing or traveling intrigued me, and so did the possibility of having a nice compact home station for general land-based packet. The emergency preparedness aspect was equally appealing.

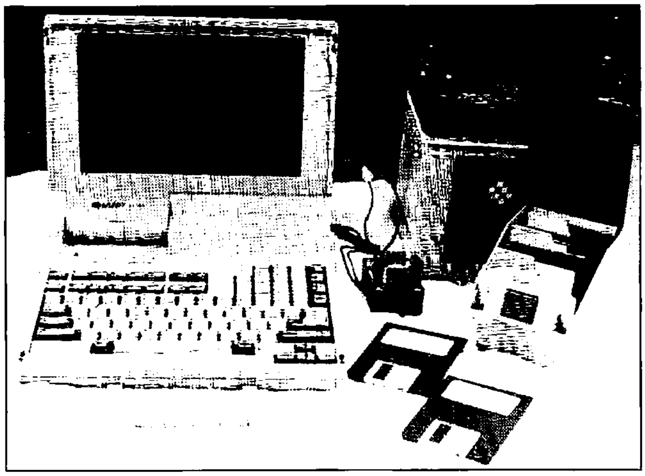


Photo A. Extended portable laptop operation using the Lappack power interface.

Since the downlinks are in the 435 to 437 MHz frequencies, and the uplink on 145 MHz, I needed portable equipment to provide that capability. After attending several hamfests, I was able to find a Yaesu FT-490R and an FT-290R, both multimode portable radios that covered the bands in question. Each unit can be powered either from an optional internal "C" sized NiCd or from external 12 volt sources. I also picked up a used MFJ-1270-B TNC very reasonably. It, too, needs a 12 volt power source. I made the simple modifications to the unit to allow the use of an external PSK modem, as required by the birds. I couldn't locate a used PSK modem, so I bought a new PacComm PSK-1, also requiring a 12 volt power source, just like all of the other equipment.

I already had a laptop, so I was now home free except for the power requirement. The laptop, a Sharp MZ-100, needed 9.2 volts DC, not 12 volts as required by all of the other equipment. Of course, I could have used the Sharp's internal battery, but that would only give four to five hours of operation. In addition to the Microsat operation, I wanted to be able to use the portable station for satellite tracking, terrestrial packet modes, propagation predictions, logging, and so on. With my camping trips always lasting a minimum of two days, not to mention the emergency angle, the laptop power requirement became the weak link to my portable Microsat station.

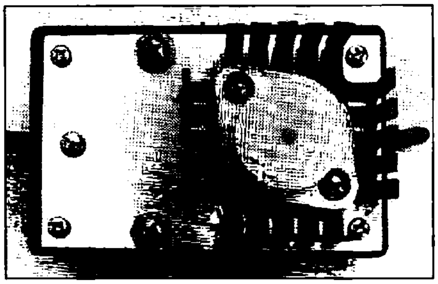


Photo B. Top view of the Lappack.

With all of this in mind, I set out to design and build a power converter which would allow 12 volt operation with the Sharp MZ-100. The first step was to ascertain the actual power requirements. Taking a look at the listed rating of the supplied AC power pack revealed that the unit supplied 9 volts at up to 2.5 amps.

I soon came up with some additional desirable features as goals:

1. Crowbar over-voltage protection.
2. A unit as physically small as home construction would allow, consistent with the subminiature size of the laptop itself.
3. Ease of construction, with easy-to-find parts. (Most parts can be obtained from Radio Shack, and D.C. Electronics can provide all the components. See the Parts List.)
4. Ability to charge the internal laptop lead acid battery, whether the machine is on or off.
5. Overall cost under $25.

After several days of experimentation, I developed the circuit shown in Figure 1.

Circuit Operation

This explanation is designed to be as basic as possible. It is intended for any newcomers crossing over from the software-oriented world of computer hacking into the world of hardware home-brewing.

Circuit operation is best explained by tracing the circuit from the left, or 12 volt input side, to the right, or 9 volt output side. The 12 volt power is brought into the unit via a pair of stranded wires of about 16 gauge, through the in-line fuse holder, the on/off switch S1, and then through D1, which provides polarity reversal protection. If the plus and minus terminals are accidentally reversed, nothing will happen as the diode only conducts in one direction. Disregarding the SCR for the moment, we reach C1, whose purpose is to smooth out any transients or short-term voltage fluctuations that might be caused by several factors, including high power equipment such as transceivers. Anything from 100 μF up to 1000 μF will work here.

Note that R1 is one-third the resistance value of R3. This means that all current through the circuit will be divided so that three times as much current will pass through Q1 as U1. Since our current requirement is 2.5 amps, and since the LM317T can only handle about 1 amp, this trick, also called a wrap-around circuit, allows Q1 to regulate the excess current. Note that U1 is still in the base-collector circuit of Q1, the pass transistor, so Q1's output is a direct representation of the regulator's output. This means that both the voltage regulation and the current limiting characteristics of the chip are directly transferred to the pass transistor, Q1.

D2 ensures that the inherent 0.6 volt voltage drop of Q1 is cancelled out. In other words, the voltage at Q1's collector will be identical to the voltage presented to the input of U1. R2 serves to ensure proper biasing of Q1. D3 prevents potential U1 failure if for some reason the output terminal voltage rises above the IC's input voltage. This situation

Parts List for Laptop Power Converter

Item	Description	RS Part No.	D.C. Part No.
Fuse	4A	270-1277	
Fuse holder	270-1281		
D1,2,3	Diode 3A/100 PIV	276-1143	1N5401
S1	SPDT Switch	275-613	SW104
SCR	SCR 6A @ 200 PIV	276-1067	
C1	100 µF @ 25 VDC	272-1016	CEM25-0100
C2	0.1 µF @ 25 VDC	272-1432	21ET100
C3	1.0 µF @ 25 VDC	272-1434	18EM510
R1	0.1Ω @ 5W res.		28PR005-.1
R2	10Ω @ 5W res.		28PR005-10
R3	0.3Ω @ 5W res.		28PR005-.15
R4	200Ω @ 5W res.		28PR005-100
R5	(See text) @ ¼W	271-XXX	
R6	10Ω @ ¼W	271-001	CF25-10
R7	1KΩ @ ¼W	271-023	CF25-1K
R8	100Ω @ ¼W	271-012	CF25-100
D4	Zener 8.2V @ 1W		1N4738
Q1	Transistor MJ2955	276-2043	MJ2955T
U1	IC LM317T	276-1778	LM317T
	Heatsink for Q1 TO-220 only	276-1363	33HS223
	Heatsink for Q1 TO-3 only		33HS306
	Mounting Kit, Q1 TO-220 only	276-1373	4724-TO220
	Mounting Kit, Q1 TO-3 only	276-1371	4725-TO3
	Heatsink Compound	276-1372	10-8109
LED	Light Emit. Diode	276-041	LR-10
	Enclosure, plastic		40UB005

D.C. Electronics order information:
Toll Free Order Line: (800) 423-0070; Stock/Price Checks: (602) 945-7736; FAX: (602) 994-1707; Mail orders to: D.C. Electronics, P.O. Box 3203, Scottsdale AZ 85271-3203. A blank PC board is available for $6.50 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

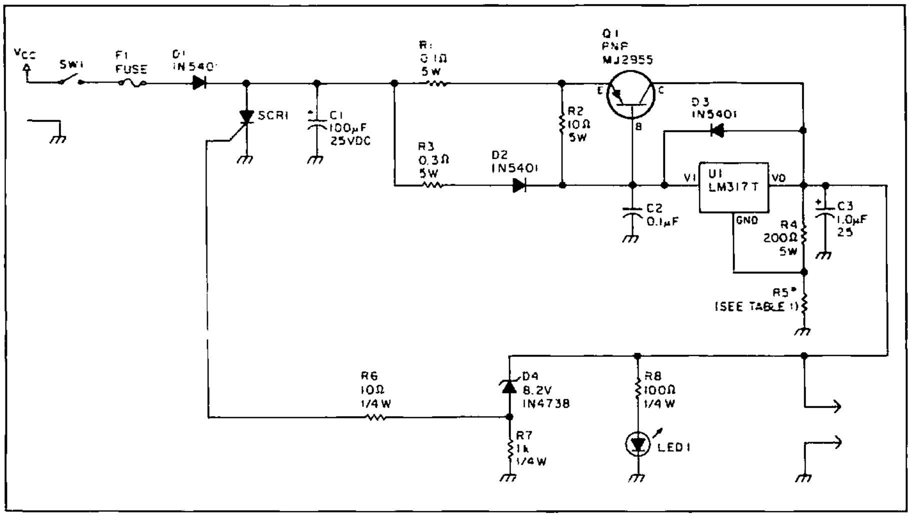


Figure 1. Schematic of the Lappack.

may never happen, but for a few cents, D3 is cheap insurance indeed.

C2's purpose is to suppress any tendency for U1 to oscillate. C3 is chosen to improve something called the transient response of the regulator. This simply means the ability of the regulator to respond to quick changes in load current. The combination of R4 and R5 forms a voltage divider that sets the output voltage of the unit. If your laptop requires a different voltage, just choose the correct resistor for that voltage, as listed in Table 1. Any value less than about 11 volts should work.

Keep in mind that the regulator needs about 3 volts above that of the input voltage in order to maintain proper regulation. D4 is a zener diode whose voltage is chosen to be slightly less than the voltage at which the crowbar shutdown portion of the circuit is to operate. If for any reason the output voltage of the Lappack exceeds the crowbar voltage, the zener conducts. This applies a turn-on voltage of more than 0.6 volts to the gate of the SCR, turning it on. The SCR will almost instantaneously short the input of the unit to ground, blowing the fuse. R8 in combination with the LED provides a simple on/off indicator.

Construction Notes

It is important to note that the SCR, Q1 and U1 are all insulated from the metal portion of the cabinet. Therefore, the Parts List includes information on mounting kits that contain insulated hardware. The photograph of the completed unit illustrates, to some degree, the technique.

There are two different types of packages available for both Q1 and U1, the TO-3 and TO-220 types. The TO-3 is the older of the two, and is the type that is used on Q1 in my unit. The TO-220 type is sometimes referred to as the tab type of mount and is the type that is used in the U1 device in my unit. Make sure that you obtain the correct kit for your particular device(s).

When mounting each of the active devices, ensure that plenty of heatsink compound is liberally applied to the surface that will contact the heatsink.

Be aware that the output jacks required by various devices can be very confusing. Many different coaxial types exist. The center pin diameter, sleeve clearance, and polarity deviate widely. You almost need a micrometer to measure the differences. Radio Shack stores quite often stock a reasonably varied inventory of these plugs.

In my unit, with D4 rated at 8.2 volts, the circuit tripped out at 9.6 volts, with the normal voltage output set to 9.2 volts. Some zener diodes have a turn-on curve that may be significantly sharper than others. This tendency can alter the point of over-voltage trip out several tenths of a volt. Since the zener costs just a few cents, you may want to buy a few diodes that are rated above and below the desired voltage.

Bear in mind that the Lappack is a constant-voltage, and not a constant-current device. It is suitable for charging lead acid type storage batteries, not NiCd types.

The Perfect Companion

This little device has more than doubled my hilltop operating pleasure. Along with a small gell cell, a 2 meter 25 watt power

Continued on page 60

R5 Resistor Value	Voltage Out
750K	5V
910K	6V
1.2K	8V
1.5K	9V
1.8K	10V
2.0K	12V
2.7K	15V
3.3K	18V
3.6K	20V
4.3K	24V

Note: Any output voltage value greater than 10V requires a higher input voltage than 13.6V. In addition capacitor working voltage ratings will have to be increased accordingly. Allow a minimum of 2.5 times the voltage expected to appear across the capacitor as a standard for the working voltage.

Table 1. Resistor value/voltage matchup.

ATV

Ham Television

Bill Brown WB8ELK
℅73 Magazine
Forest Road
Hancock NH 03449

Everything's Coming Up Roses

Every year ATVers across Southern California join forces with members of the Tournament of Roses Radio Association (TORRA) to help cover the annual Pasadena Tournament of Roses Parade.

Any event that brings in over a million spectators along a 5-1/2-mile route requires a massive support system to make sure things run smoothly. Anything could happen during the parade: the intricate floats can and DO break down, various medical emergencies crop up, and sometimes unruly spectators and even organized protestors impede the progress of the parade. Without proper communications, keeping the parade on track could be a logistical nightmare.

Eyes In the Sky

In order to help out with the communications effort, ATV camera locations were perched on top of several buildings (as well as the main viewing stand) along the parade route. From their rooftop vantage points, they could see just about any part of the parade route by zooming in on the trouble spot. Twenty-four ATVers at nine remote camera locations and mission control took part (see the sidebar). The ATV net control station (Koichi KB6EL) communicated with the remote camera sites via the 145.18 MHz telephone company club repeater.

The Video Relay

In order to send the video back from each site over such a large route, each camera location would transmit on 434 MHz back to the WA6SVT/KI6VK ATV repeater (the Crestline Amateur Television Network repeater was borrowed for the parade) which was centrally located on top of the telephone building. The repeater received the remote camera video on 434 MHz and retransmitted it out on 919.25 MHz. From this central hub repeater, the signal could be received by any of the command centers that needed to observe the parade.

ATV receive sites were located at ATV net control in the command trailer, TORRA command, the media room, public safety and the city of Pasadena Sheriff's Department. In addition, most of the remote camera locations had 919.25 MHz downconverters so that they could watch the other remote cameras coming through the repeater.

If any of the centers needed to see a particular part of the parade, they just

Photo C. Jeff N9CZA mans camera 10 from the roof of the video van at the end of the parade route.

Photo A. The rooftop view from camera 6B allowed the parade command center the capability to observe several miles of the parade route. The Starship Enterprise float can be seen as it progresses down Colorado Boulevard.

Photo B. Jim KC6TFV demonstrates the inner workings of his mobile video production van (camera 10).

Camera Positions for the Rose Parade

ATV net control (command trailer)—Koichi KB6EL
Mission control troubleshooters—Mike WA6SVT and Paul N6VLV

Camera 1—Mike KB6IZK and Greg KD6AIS
Camera 2—Eva WA6YQT and John WB6YQT
Camera 3—Greg N6TDZ and Tom KK6YU
Camera 4—Cam KI6VK, Barry KC6OXK and Sue Burke
Camera 5—Doug WB6KNY and Mark Shlosberg
Camera 6A—Bob W6LUY and Robert KBØDC
Camera 6B—Frank K1HHM and Dick WA6BYJ
Camera 7—Jan WB6VRN and David WA6PMX
Camera 8—John KB6MMF and Bud KB6MID
Camera 10—Jim KC6TFV, Jeff N9CZA and Richard N6CIZ

had the ATV net control station ask the nearest camera site to transmit.

ATV In Action

Throughout the course of the parade, each camera crew got their chance to zoom in on a trouble spot. One of the floats veered off course and nudged into the crowd, and some mechanical breakdowns of the floats were observed (a couple needed towing). ATVers even had the opportunity to point out one recurring trouble area. Since the theme of the parade was the 500th anniversary of the discovery of America by Columbus, a number of Native Americans were set up at one spot along the parade route in protest. They even delayed the parade for a short time. Whenever an equestrian group passed, the Indian group would beat on tom-toms, which caused at least one rider to be thrown off his horse. As a result, a contigent of police lined the streets along this portion of the parade to help maintain order.

Several of the rooftop ATV locations had good views of the area, which helped parade officials keep an eye on the disturbance. The ATV effort worked well throughout the parade, and certainly helped parade officials keep track of the parade in an effective way that would not have been easily done through other means.

Helping Out

This kind of activity really helps demonstrate the value of amateur radio to your local community. If your ATV group offers assistance for a public event, or if you use ATV in support of a special activity, I'd like to hear about it. Also, if you've built a video device, circuit or gadget that enhances your ATV station, send me a description or schematic so we can share it with our readers. ■

The Lappack

Continued from page 54

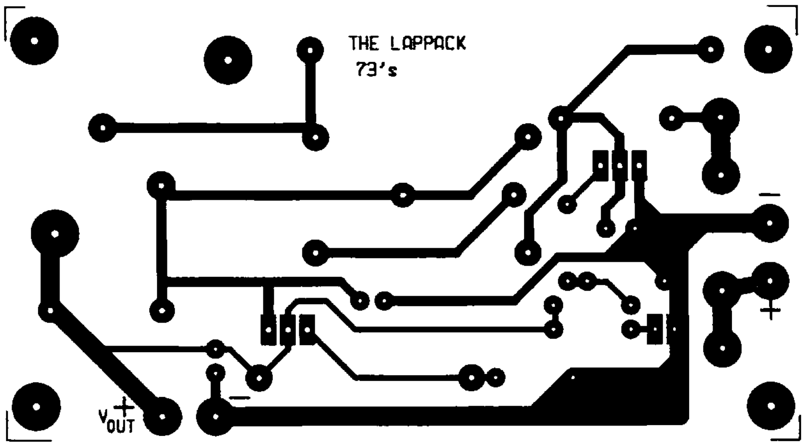


Figure 2. PC board foil pattern.

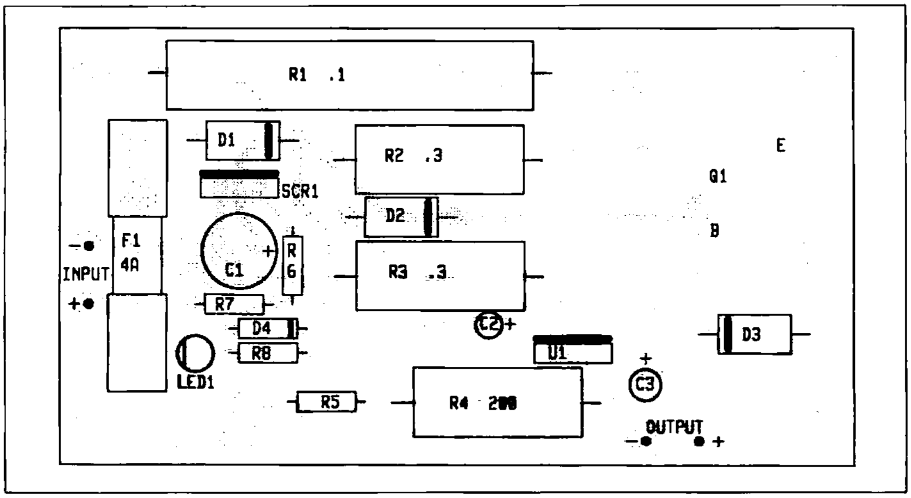


Figure 3. Parts placement.

amplifier, and a solar panel, I can run for many days and have a real feeling of independence. This might sound like a lot of stuff to transport, but it all fits easily into a standard size gym bag. I have plenty of room to spare in my sports car for the more mundane, but necessary, items such as food, stove, tent, etc.

I can schedule and work the Microsats, download mountains of mail from the local BBS's, or leave messages for my friends via the network nodes that are popping up all over. Best of all, the still beauty of the campsite setting is left unscathed by noisy, smelly generators. With computer communications, I don't even have to listen to the data. Only the keyboard clicks can be heard through the pines. Give this simple project a try. You may find yourself wandering to the campsite a bit more often, putting a crimp in the myth that hams are a generally indoor, out of shape physically unfit lot. 73

Contact Brian Kassel W5VBO at 9200 West Hollywood Ave., Peoria AZ 85345-5529.

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

More great events happening in the world, the dissolving of the USSR and the formation of the Commonwealth of Independent States! I have felt very sorry for the citizens in the USSR in the past because of the lack of food in the stores. Even though the prices were kept low by government control so that the citizens could afford the items, that is no good unless there are also goods to purchase, goods that the citizens truly need or want.

The new CIS government has now (as of January 2) increased the prices of goods to what they assume will be an approximate "market economy" price. That is an appropriate first step, BUT, the citizens' wages and pensions have not increased by a like amount to match the cost of living. Guess what, sports fans, there are going to be even more hungry people in the CIS because even if more goods become available now that prices have increased (more suppliers willing to sell because of increased profit), fewer people will be able to afford the items because of inflation.

Now, let's look at what is going to happen to the new government economically. The government also needs things which must be acquired by money. They have to either cut back on their purchases to control their spending, or they must come up with more money. I sure hope that they don't do it the way that the USSR government was doing it—by printing more money—because it just won't work. It just makes each ruble worth less. Diluting the value of the currency, things are going to get much worse before they get better!

Enough of Economics 101 and my soapbox. We are very lucky to have a report on Slovenia written by Mate Lenard VE3TJA. If you don't know what or where it is, you haven't been listening very closely to the international news.

We still need YOUR news from YOUR country. We need more Hambassadors. Do your part and either send your country's latest happenings, become a 73 Hambassador, or both. I will be looking forward to hearing from you. Send it by mail directly to me at my address at the beginning of the column, or to 73 via FAX or the 73BBS. Address the electronic mail to "Arnie, 73 International," and I will be sure to get it. 73—Arnie, N1BAC.

Japan

From *The JARL Newsletter:* The 8th General Conference of the International Amateur Radio Union (IARU) Region 3 was held from October 8th through the 12th in Bandung, Indonesia. Eighteen countries or territories of the twenty-four member societies participated in the conference, bringing the total number of participants to exceed 100. When it was reported that Bangladesh and Sri Lanka had sent delegations for the first time, and additionally that Bangladesh had begun the official issuance of amateur radio operator licenses, the conference hall resounded with thunderous applause.

The conference organized four different working groups, in addition to the regular committees for more specialized deliberation on (1) revision of the Constitution, (2) technical matters such as band plans, packet, etc., (3) promotion of amateur radio in developing countries, and (4) ARDF.

At receptions given by the IARU/ARRL, JARL, and ORARI respectively, participants were seen mingling together cultivating new and international friendships, promising to keep each other updated on any new developments. The Conference selected Singapore as the venue for the 9th General Conference, 3 years hence.

All Japan ARDF Competition '91

Surrounded by beautiful autumnal colors, the All Japan ARDF Competition '91 was held on October 20th, under the auspices of JARL, in the "Green Park," a sports leisure land on Asagiri Heights, Fujinomiya City in Shizuoka Prefecture. In addition to about 250 participants who came from all over Japan, there were 12 Chinese and 7 Korean competitors invited to this event. Moreover, 3 participants from the Soviet Union were also in the group.

The ARDF competition is different from the 100 meter running races and anything else. The ranking is not known until the number of discovered transmitters, and the time required for every competitor, has been collected. There are also four classes in the competition: (1) YL: female only, no age restriction; (2) JN class: male, younger than the age of 19; (3) OM class: male, the age of 19 and older but younger than 40; and (4) OT class: male, the age of 40 and older.

In the OM class, JL2JXL, Mr. Yoshiuki Yano discovered five transmitters in 54 minutes 10 seconds, which was quicker than winners of other classes by 30 minutes or more, and was thus considered a brilliant victory. Other class winners were: JN—Mr. Xu Feng of China; OT—Mr. Takayuki Matsuura JH5FUL; and YL—Miss Yoshiko Takahashi.

Slovenia

Report from Mate Lenard VE3TJA: Slovenia will be, in the not too distant future, recognized as a sovereign and independent state. As such, the amateur radio fraternity worldwide will become enriched by this new country and its group of very dedicated amateur radio operators. It may therefore be in order to take an advanced look at what will be in store for the amateur radio community as a whole.

The Republic of Slovenia, which declared its independence on June 25, 1991, is located in the northernmost part of what was until recently Yugoslavia. Geographically speaking, Slovenia borders on Italy, Australia, Hungary, and Croatia. While mainly a mountainous country, there are many beautiful valleys, lakes, and rivers, and the towns and cities are full of historical treasures collected throughout the centuries, some of which extend back as far as Roman times.

There are about 2,000,000 hardworking and well educated Slovenes in Slovenia, and with respect to amateur radio there is one licensed operator for each of 400 inhabitants. This ratio corresponds to those in other developed countries. The first Slovenian hams began to operate around 1930, mainly in Ljubljana, the capital city of Slovenia.

During World War II, many hams went underground, working for the various political factions in their homeland, which had affiliations with Allied governments. After the war, the real upswing began in the later part of the decade when the Slovenian radio amateurs formed their own organization, which of course was an integral part of the Yugoslav Amateur Radio League. This in turn was controlled by the Yugoslav communist government, as was the case in other Eastern European countries. Because of this, and because it was practically impossible to buy transmitting equipment at that time, nearly all activities were conducted in radio clubs. There, the classes were conducted and the equipment was built, or rebuilt, from parts and stations left over by the Italian and German occupation armies, or those parachuted in by the Allied forces during the war. Because of this, large groups of excellent operators emerged.

Slovenian operators represented, until recently, 30% of all operators in the remaining five Yugoslavian Republics. They have participated in national, European, and world contests, and were often rated among the best in the world. In the true ham spirit they were always ready to help when natural disasters struck their country. Just a few months ago, in June and July 1991, when the Yugoslav Army invaded Slovenia, the ham radio operators in slovenia contributed a great deal toward the defeat of the Yugoslav Army by the Slovenian Territorial Defense Forces.

In the spring of 1991, the 19th Conference of the Slovenian Amateur Radio League (Zveza Radioamaterjev Slovenije [ZRS]) was held, a new constitution was accepted, and Board of Directors were elected for the period of 1991—1994. Elected were: President Stipanic Anton YU3BH, Vice-Presidents Blenkus Gojmir YU3AW, Kuselj Janko YU3RW, and Vehovc Joze YU3EJ. The Control Branch and Legal Section consists of experts in their respective fields. For the present, the Slovenian hams are using the old Yugoslavian prefixes YT3, YU3, YZ3, and 4N3 (number 3 being Slovenia). A new prefix depicting the independent Slovenian State is expected to be in force soon.

Out of 4,759 members there are presently 3,324 home-based operators, with the remaining 1,435 hams active in some 88 radio clubs across the country. The ZRS publish a bimonthly "CQ YU3" magazine, which was just renamed to "CQ ZRS." This is a highly technical publication, put together by Slovenian experts of such caliber as Matjaz Vidmar YT3MV, who was a Fulbright Scholarship recipient at the University of Colorado. Mr. Vidmar has in the past designed and built highly efficient transmitters for NASA spacecraft (see *QST*, MAY 1989, p. 39). He has returned to Slovenia because he was "craving for good, homemade Slovenian food and wine." Hi!

Photo A. Left to right: Joe 4X6KJ, IARC Chairman, and Ron Gang 4X1MK, filling out certificates for participants in the Israel 40th Anniversary Contest, worldwide.

Continued on page 64

Number 10 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

Have a quick'n'easy circuit idea? Share it and get a one year subscription or extension to *73*! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, *73 Magazine*, Forest Rd., Hancock, NH 03449.

Measuring RF Power

Figure 1 illustrates a simple gadget enabling the measurement of RF power dissipated in a 50 ohm dummy load within a few percent. It covers from 10 to 1800 watts in three ranges. It can be calibrated with a variable DC power supply at voltages equivalent to the RF power in watts applied to the dummy load, as modified by the internal circuitry illustrated. The range of RF rms voltages across 50 ohms varies between 22.4 volts at 10 watts to 300 volts at 1800 watts. A voltage divider and a pair of zener diodes reduce this wide voltage range to less than 10 VDC, which is calibrated in watts on three scales.

Table 1 gives the equivalent voltages applied to the meter when the matching power level in watts is applied to the dummy load. The meter, with its series multiplier, is set to measure a full-scale DC voltage of 10 volts.

Figure 2 illustrates the connection of this gadget to the dummy load and transmitter/transceiver RF output. The transmitter/transceiver must be operating on CW when using this gadget.

This gadget must be built in a shielded enclosure and a shield placed internally to prevent any RF leakage into the meter and multiplier area. A T-connector allows connection of this gadget and the transmitter to the dummy load.

J. Frank Brumbaugh KB4ZGC
Buffalo NY

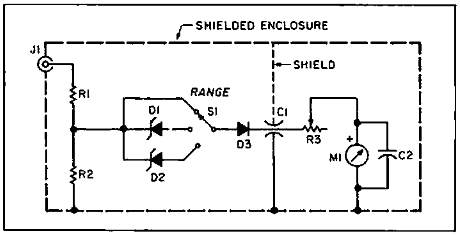


Figure 1. The gadget.

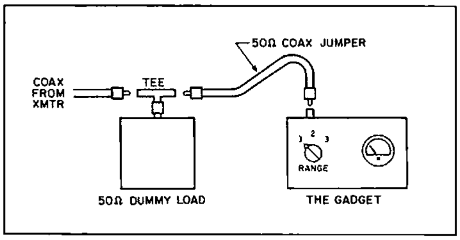


Figure 2. Operation.

Table 1. Calibration

Range 1 Watts	Range 1 Volts	Range 2 Watts	Range 2 Volts	Range 3 Watts	Range 3 Volts
10	2.24	300	1.20	900	2.12
25	3.54	400	4.14	1000	2.24
50	5.00	500	5.80	1250	5.00
75	6.12	600	7.32	1500	7.40
100	7.07	700	8.71	1800	10.00
125	7.90	800	10.0		
150	8.70				
200	10.00				

Parts List

R1	9.1k ¼W 5%
R2	910 ohm ¼W 5%
R3	Meter multiplier (see text)
D1	10V zener (1N758; 1N961; 1N5240; 1N5856; 1N6000)
D2	20V zener (1N968; 1N5250; 1N5540; 1N5866; 1N6007)
D3	Germanium diode (1N34A; 1N90; etc.)
C1	Feed-through capacitor, 0.001 to 0.01 µF
C2	0.01 µF disc capacitor
J1	SO-239, or connector to match coaxial cable from transmitter
M1	DC milliammeter, 100 µA to 1 mA
S1	1-pole, 3-position wafer switch

73 INTERNATIONAL

Continued from page 62

The Slovenian Amateur Radio League is striving to widen the ham spirit in their homeland according to the guidelines of the International Amateur Radio Union (IARU), and thus wishes to contribute to an even greater success of this world movement.

For additional information please contact: Zveza Radioamaterjev Slovenije (Slovenian Radio Amateur League), Lepi pot 6, YU-61000 Ljubljana, Slovenija. Tel: (+38-61) 222-459.

[Mate VE3TJA and Tom VE3VKE toured Slovenia, Bosmia-Herzegovina, and Croatia in 1990 and met over 200 hams. If your club is interested in a slide presentation, please contact Mate Lenard, 118 Princefield Rd., Toronto, Ont.Canada M4W 1Z9, or call (416) 925-0359. Mate was asked to write this by his good friend, Joze Snoj YT3ZG.—Arnie]

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
Packet: 4X1MK4X4SV.ISR.EU

THE HOLYLAND DX CONTEST
Israel—1992

From Saturday April 18th 1800 UTC through Sunday April 19th 1800 UTC, the Israel Amateur Radio Club is sponsoring a contest open to three categories of participants worldwide: 1. Single Operator, 2. Multi Operator, single transmitter, and 3. SWLs. Both SSB and CW may be used on 160, 80, 40, 20, 15, and 10 metres, according to IARU Region recommendations.

Worldwide stations contact only Israeli stations, and send RS(T) and QSO number, and Israeli stations give RS(T) and area designator. The same station may be worked both on SSB and CW on each of all six bands, but no cross-band or cross-mode contacts are allowed.

The final score is the sum of QSO points (2 points for QSOs on 160, 80, and 40 metres, and 1 point for 20, 15, and 10) multiplied by the number of area designators worked per band. An area designator consists of a letter, two digits, and two more letters—i.e., E14TA or H08HF, the first three figures designating a particular grid square on the map of Israel, and the last two letters the administrative region.

Entries postmarked no later than May 31, 1992, go to: Contest Manager, Israel Amateur Radio Club, Box 4099, 61040, Tel-Aviv, Israel, and must consist of separate logs for each band and mode including time, callsign, RS(T), and QSO number sent, and RS(T) and area received. SWLs log only Israeli stations. Include a summary sheet listing number of points and multipliers per band, and a score calculation as well as a declaration of adherence to contest rules and licence regulations.

A trophy will be awarded for the winner in each category, a plaque for each continental winner, and certificates to the top scorer for each country having made at least 50 QSO points. 73

Number 17 on your Feedback card

UPDATES

The Quag-V—Again

See the above article in the December 1991 issue, page 36. See also last month's update on the boom length for the 146 MHz section, which should be 14 feet (not 12). Now, before you build this antenna, see the Figure. Change the driven element and reflector angle to eliminate a double lobe off the front of the antenna's radiation pattern.

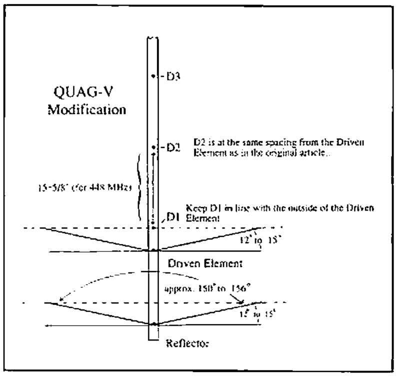


Figure. The modified Quag-V antenna.

Function Generator and Surplus Meters

See the two articles above, on pages 28 and 42, respectively, in the January 1992 issue. J. Frank Brumbaugh KB4ZGC writes: "In the 'Function Generator' article on page 28, the second paragraph under 'The Circuit' should read: 'Lowering the frequency *increases* their amplitude; raising the frequency *reduces* their amplitude, providing less gain.'

"In the 'Surplus Meters' article, Figure 2 on page 42, the meter should be a 1 mA meter (or else the dropping resistor should be 200 ohms). In the text on page 45 where Figure 2 is discussed, change '5 mA' to '1 mA' in the fourth paragraph under 'Voltage Multiplier Resistance.' "

Pseudo CW Filter

See the above article in the June 1991 issue, page 18. Chet Garrison W6ZZB writes that the schematic diagram should indicate that pins 4 and 8 of the 555 IC are shorted together. The "dot" indicating the connection is missing from the diagram.

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
℅73 Magazine
Forest Rd.
Hancock NH 03449

More Mixing

Last time, we were discussing receiver anatomy. Let's continue.

As I was saying, when you pass two signals through a nonlinear stage, they interfere with each other, or "mix." (Another word for mix is "heterodyne.") This results in a complex composite signal at the stage's output. The mix can be separated into four distinct signals: the original two, plus their sum and their difference frequencies. It is also possible to construct a mixer which outputs only the sum and difference signals, rejecting the original input frequencies. Such a mixer is called "balanced," and is essentially the same circuit as the balanced modulator used in generating sideband signals in a transmitter.

So, why do all this anyway? Well, if one input signal is the one you want to receive (or a jumble of frequencies containing it) and the other is from a local oscillator (in the radio), you can vary the apparent frequency of the received signals by varying the local oscillator's frequency. Example: the signal you want is at 14 MHz. If you mix it with a 5 MHz oscillator, you will get signals at 9 MHz and 19 MHz, because those are the sum and difference frequencies. If you shift the local signal by 1 MHz, the mixer's output signals will shift by the same amount.

By making a tuning dial which controlled the tuned antenna circuit and the local oscillator's frequency at the same time, Armstrong was able to make any given station's signal appear to the receiver's subsequent stages as if the signal were on one predetermined frequency. No matter where you tuned, the local oscillator would track your tuning at the same offset (say, 5 MHz from the tuned frequency), so the mixer's "difference" output *for that tuned frequency* would always be the same as the offset frequency, in this case 5 MHz. Of course, other stations on adjacent frequencies which made it through the tuned circuit in the front end would be mixed to new frequencies adjacent to the offset frequency, too. But at least you could be sure that the signal you wanted was on the offset frequency, no matter what the station's original frequency was.

This brilliant idea gave Armstrong the solution to the Holy Grail of radio: selectivity.

An "I.F.FY" Proposition

Ok, so we've got a band of frequencies, and we know the one we want is on our predetermined frequency of 5 MHz, no matter where it started. So what? Well, now we can feed it to a chain of amplifiers tuned for that frequency, that's what! Such stages are called Intermediate Frequency, or IF, stages, and they are where we get most of our selectivity.

The Immovable Object

The steeper the resonant peak of a circuit, the more selectivity it has, because it passes what's in the peak and rejects what's not. That much seems obvious. However, easily tunable things like coils and caps just don't have enough "Q" (Quality factor, or steepness of resonance) to separate radio stations which are fairly close to each other. Sure, you can cascade several of them into a chain, but how do you tune them all at the same time as you change frequencies? And the really narrow, tight devices have the unfortunate characteristic that you can't tune them; they must be designed for a specific frequency. Examples of such filtering devices are crystals, ceramics and mechanical filters.

But wait a minute, we now have a situation where we are only trying to amplify one frequency, while losing all the others. You guessed it, it's a marriage made in RF heaven.

In Armstrong's early days, things like crystal filters weren't conceivable for home receivers. Heck, I doubt they even existed back then! But a series of LC-tuned amplifiers, all set to the mixer's difference frequency (called the intermediate frequency), worked very well. Not only was there lots and lots of gain which couldn't cause trouble by feeding back into the front end (because it was on a completely different frequency band), but there was much more Q, thus more selectivity, than had ever been dreamed of before! At last, stations could be separated with *no* interference. The battle was won. Or was it?

Images

Well, sort of. As more and more frequency bands began to be used, a new problem arose, even with the amazing superhet design. Remember how that 14 MHz signal mixed with the 9 MHz local oscillator to get the 5 MHz IF? Well, what's to prevent a signal at 4 MHz from mixing with the 9 MHz local and creating another 5 MHz product? Remember, addition and subtraction both produce the same result! At the output of the mixer, such a signal would be indistinguishable from the one you wanted. Unfortunately, it happens, and these false signals are called "images." "Ah," I hear you say, "but the tuned circuit at the beginning should prevent that!"

Playing the Percentages

LC circuits function as a percentage of their total frequency. By that I mean that a tuned circuit's response may fall, say, 6 dB from its peak of resonance in perhaps 5 percent of the frequency it resonates on. Thus, a 10 MHz LC with such a 5 percent characteristic will fall 6 dB when signals 0.5 MHz away from 10 MHz are fed into it. By the same token, a 500 kHz circuit's response will fall the same amount within 25 kHz. That means that the higher the design frequency, the wider the response.

For AM or SSB stations to be received without interference, they must be much more than 6 dB down from one another. Even at 30 dB down, an interfering signal is a nuisance. So, it is important to keep the images as far away as possible from the signals we want, and the way to do that is to make the Intermediate frequency as high as possible.

> **"This brilliant idea gave Armstrong the solution to the Holy Grail of radio: selectivity."**

Contradictions?

"What?" I hear you say. "If the coils get wider as the frequency goes up, why would I want to go up?!" Well, let's look at an example. Let's say we want to receive a station transmitting on 5 MHz. If we use a low IF, perhaps 500 kHz, then the local oscillator will be running at either 4.5 MHz or 5.5 MHz, resulting in the 500 kHz IF at the output of the mixer. (Remember, either one will work because all that matters is the difference frequency between the oscillator and the signal.) For convenience, let's say that the oscillator is running at 4.5 MHz. That means that the image frequency is 4 MHz, because that frequency will also result in a 500 kHz signal when mixed with the 4.5 MHz local oscillator. Heck, that's only 1 MHz from the signal we want, and only 20% of the total frequency of the 5 MHz signal we are trying to receive. It is reasonable to assume that some of that 4 MHz signal will get through the front end's tuned circuit and be heard.

Up, Up and Away

Now let's look at the same situation, but with a high IF. Let's say we mix the incoming 5 MHz signal with a 50 MHz local oscillator, resulting in a 45 MHz IF. The image frequency is now 95 MHz, which is 19 times the frequency of the desired signal! How much 95 MHz signal do you think will make it through a 5 MHz tuned circuit, or even a simple bandpass filter? See, this technique makes the initial tuned circuit tremendously more effective and virtually eliminates images.

Unfortunately, the high intermediate frequency also suggests that the selectivity of the IF stages will be less, due to the same percentage effect. So, we're left with a contradiction: good image response or good selectivity, but not both. Is there a way out?

Once is Never Enough

Sure. Why not start with a high IF for good image response and then convert its output *again* to a low IF for good selectivity? Let's say we are trying to receive that station on 5 MHz. We mix it with a 50 MHz local oscillator, resulting in signals at 55 and 45 MHz, and with essentially no images. We run them through a few tuned circuits at 45 MHz, then mix them with a 45.5 MHz oscillator. Now we've got signals at 500 kHz and 90.5 MHz, perhaps along with some small ones at 100.5 MHz. The unwanted signals are up in the stratosphere and completely disappear when we feed the mess through our nice, narrow 500 kHz IF stages. What's left is *only* the one we want. At last, we've got truly great selectivity and the image problem is gone.

Such a design is called "double (or dual) conversion," and most modern receivers are made this way. In fact, many good communications receivers and ham transceivers carry the idea to the extreme by employing triple and even quadruple conversion. Remember, once you've done the first conversion, all the signals you want are on one frequency, and you can use fixed local oscillators to do subsequent conversions; only the first local oscillator needs to track the tuning.

Well, there's still more to receiver design. In particular, the topics of gain distribution and dynamic range. Next month, we'll finish it up. Now, let's look at a letter:

Dear Kaboom,

I use a tape recorder to log contacts. I notice that when I transmit on VHF FM, the recorder's speed drags! Also, there's a buzz in the audio when I play it back. Is there any way to fix it?

Signed,
Wobbly

Dear Wobbly,

You are getting RF into the recorder. The speed change suggests to me that your recorder uses a servo circuit to maintain tape speed and it is getting trashed by your signal. The audio buzz is basically the same problem. Most recorders are not shielded very well, if at all, so there's not much you can do except try a different machine or move the RF farther away. Try a cheap recorder; they usually don't have servos. Of course, the audio may still buzz, but at least the buzz will stay at the same pitch!

See you all next month! 73

HAMS WITH CLASS

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Home Sweet School

The rapidly growing movement of home schooling as an alternative to conventional American education has long fascinated me. According to the article "Schooling in Family Values," by Thomas Toch, in the December 9, 1991, issue of *U.S. News & World Report*, the number of students educated at home has swelled from 10,000 in 1970 to over 300,000 today, an increase that shows no sign of slackening. According to this article, about 75 percent of home schoolers are conservative Christians who stress the Bible in their teachings and who lament what they see as a decline in traditional values in the public schools. Others are of the belief that public schools don't set high enough academic standards. But all home schoolers seem to share the belief that education is integral to family life.

Lead by a very aggressive home school lobby, the movement has been successful in getting 34 states to pass measures since 1982 that have eliminated many of the legal barriers and have eased the way for home schooling, primarily by relaxing teacher-training and curriculum requirements.

At its best, home schooling has many of the attributes that school reformers have sought for public schools, including more personal attention and more hands-on learning experiences. "It's handicraft versus mass production," says Roger Creech, a public school teacher who shares the instruction of both his 13-year-old daughter and 12-year-old son with his wife, Kathleen. Studies that

Photo A. Studies have shown that home study students do just as well as their counterparts in public schools. Janet KB5OWF (at right) teaches her daughters (from l to r) Marie KB5OPB, Shalon KB5OMY and Linda KB5PDW. Regular contacts have been made with the CQ All Schools Net on 28.303 MHz.

Photo B. Uncle Bernie instructs the girls in the ham radio class.

have been conducted suggest that home-schooled students do as well or better than their publicly-schooled counterparts on national standardized tests. Anecdotal evidence suggests, perhaps more importantly, that youngsters schooled at home are independent and inquisitive learners.

While it is not my intention to present a case either for or against home schooling in this particular column, I must in all fairness say that there are many educators and sociologists who are quick to point out the negatives of home schooling. Although home-schooling parents are typically better educated and more affluent than the national average, few are qualified to teach their children more advanced courses like calculus and chemistry. Nor can they offer many resources vital to good education which include science labs, foreign language laboratories, athletic equipment, and so on. Critics are also concerned with the lack of opportunity for home-schooled youngsters to interact in group situations like gym, chorus and other socially important activities.

Whatever your thinking may be on this controversial topic, it's important to at least be aware of its existence as a growing phenomenon in American education as an alternative means of teaching young people. It recently became prominent in my thoughts when I had the pleasure of encountering the Giesen family from Houston, Texas, on the CQ All Schools Net.

Janet Giesen KB5OWF is the mother of three terrific teen-aged daughters, all of whom are ham radio operators. Not only are the Giesen children schooled at home, they are also fortunate enough to be getting ham radio instruction included in their curriculum. Is there anyone out there reading this column who can't think of the thousands of possibilities for creative, highly motivational lessons these parents can be using on a daily basis? What a terrific opportunity!

Shalon Ann Giesen KB5OMY is 14 years old. She was the first Giesen family member to contact us on the net. It was really interesting for the children in my 6th, 7th, and 8th grade ham radio classes to learn about home schooling, a subject very few of them knew anything about. Shalon explained that she has many friends in their home-school support group, a group of families that also provide home schooling for their children. They are very friendly as a family with another home-school family on their same street. The Giesen children do get the benefit of specialized instruction by having a band teacher work with them on their music.

Shalon had us all fascinated as she described her typical school day. She runs long distances in the morning since she is training for the marathon. Next, she has Bible study and breakfast with the family. Math is the first subject of the day because Shalon feels her thinking is the clearest then. The rest of the school day doesn't follow the same order. She does music study, vocabulary, science, social studies, art, and spelling. She also has quiet time for prayer or meditation. Unlike in other schools, her school day is over as soon as she has completed her assignments. Shalon is in her fourth year of home instruction and likes the one-on-one attention very much. She also enjoys the ability to be flexible with the school day if something unforeseen comes up.

The girls got interested in ham radio when their Uncle Bernie, who lives with them, announced that his company, Compaq, was giving free lessons. It took Shalon four months to get her license, and she claims that learning the Morse code has helped her in her spelling work.

Linda KB5PDW is also 14 years old. She told me that one of the reasons her family decided to home school was that she was having some difficulty in the fourth grade. The second reason was that since the three sisters were adopted three years ago, it helped to bond them as a family. Linda explained how they have the benefit of being taught about the law by dad, an attorney who works at home. He also coaches the girls on running. Uncle Bernie teaches the girls science and is affectionately referred to as Mr. Science.

Some of the field trips the girls have gone on are: the bakery, ice carving events, the power plant, McDonalds, museums, the sugar factory, the ice cream factory, and Wheels, a charity for those who can't afford groceries.

Ham radio became one of their subjects, Linda told me, because it helped them to improve their spelling and test-taking skills. It also helped the girls improve their listening skills, and it has helped give them confidence in conducting a conversation. She feels that their math and science have also improved as a result of ham radio.

Marie KB5OPB is 12 years old. She is absolutely delightful to speak with on the radio. When Uncle Bernie suggested that they all take advantage of the free ham radio classes being offered by Compaq Computers, he couldn't convince Marie that it wouldn't be boring. He got his license first, and once Marie heard him talking on the radio, she got hooked. Some of her favorite contacts were made with hams in England, Utah; Spring, Texas; and Marshall, Texas. She says that her new favorite is the CQ All Schools Net. Marie looks forward to speaking with the other children at my end in Staten Island, New York. She has become a regular Thursday check-in on our net, and she says she enjoys the chance to exchange news and information with the other youngsters on the net every Thursday at 17:30 UTC on 28.303 MHz.

My students and I look forward to speaking with the Giesen family every Thursday. They are excellent examples of a caring, innovative family deeply concerned about family values and the quality of their children's education. How fortunate for all of us that we can share some of their experiences through ham radio.

Number 19 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
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Home-Brewing Hints and Heroic Hunting

I am constantly amazed by the wide interest in radio direction finding (RDF) competitions, which are called transmitter hunts, foxhunts, T-hunts or bunny hunts, depending on where you live. The mail this month included inquiries from all over the USA, plus Canada, Colombia, and Greece.

I love trying out new RDF circuits, but I am too impatient to worry much about mechanical issues when I build prototypes. The equipment works, but often gets beat up quickly. That makes it fail at the worst possible time—in the middle of a hunt. Then I am faced with patching it up. Or I could rebuild it the right way. Nah, there just isn't time. So my 6 meter mobile quad still has wooden dowel spacers that break every so often, and the wiring in my "sniffer" box looks like the web of a brain-damaged spider.

Photogenic Projects

I have a deep appreciation for hams who have the patience and mechanical skills to make gear that works right, looks good, and lasts a long time. One such builder is Dave Pelaez AH2AR, who sent some pictures of his work.

Photo A is Dave's dual-antenna "sniffer" for 440 MHz. He used the plastic handle from a device intended for cleaning paddle fan blades. With a twist of the wrist, it is extendible to allow the antenna to be held high overhead. The whips are 3/32" bronze brazing rod soldered to thick PC board material. Lands for the antenna terminals and other components were etched by the photoresist technique.

For extra ruggedness, Dave potted the electronics in the box with epoxy resin and hardener. "You could crack walnuts with it," he says. Nice work! My only suggestion would be to glue some plastic balls to the whip tips for eye protection.

This technique is fine for the 70cm band, but things get a bit too big at 2 meters. At 144 MHz, it is better to be able to remove the whips for transport and storage. But when you take them apart, you inevitably lose some important piece. That is why a fold-up antenna is even nicer.

AH2AR's version of a fold-up 2 meter homer is shown in Photo C. He calls it the T-squared model because of the red T-shaped pieces on the ends. He mounted the dipoles (1/4" surplus aluminum welding rod) to thick phenolic material with standoffs (see detail in Photo D). The boom is a square plastic towel rack pole. Other builders have cloned his design using a square extruded aluminum boom, with equal success.

The end pieces pivot, and the whole thing folds up when not in use (Photo E). Bolts and wing nuts at the pivot points hold everything in place in either configuration. For electrical design information, see "Foxhunt Radio Direction Finder" by Paul Bohrer W9DUU in the July 1990 issue of *73 Amateur Radio Today*.

Dave lives in Huber Heights, Ohio, which is just north of Dayton. Hams there are known for their public service activities and their world-class annual convention, but not for T-hunting. They have had to "import" DFers from the crack Indianapolis foxhunt group to help locate their high altitude balloon experiment payloads.

With urging from AH2AR and others, the Dayton Amateur Radio Association (DARA) is holding its first annual Winter Foxhunt. Dave hopes there will continue to be regular hunts, at least two or three per year, to train DARA DFers to find their own balloons and help police the bands.

Photo C. Jason Pelaez (AH2AR's son) shows off the two meter homer in their spacious back yard.

We Save Your . . .

A well-known maker of search/rescue RDF gear (L-Tronics, Incorporat-

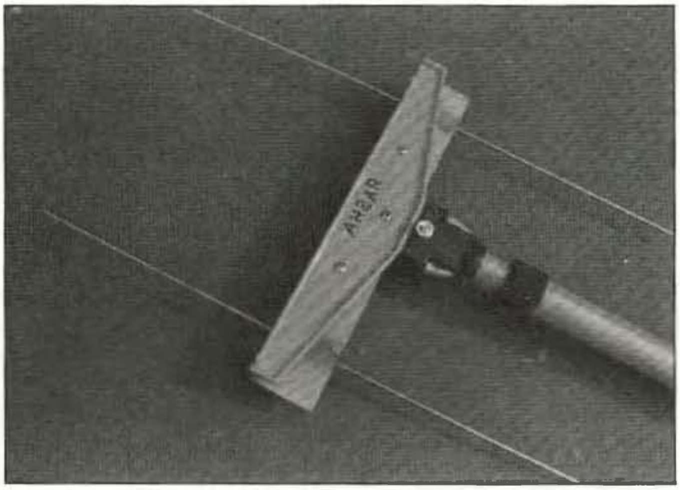

Photo A. Dave Pelaez AH2AR built this 70 cm homing DF set out of an extendible handle he found at the hardware store.

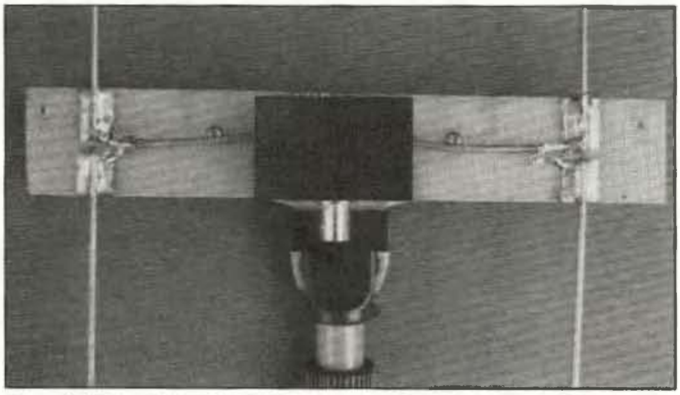

Photo B. Dave soldered his UHF antenna whips directly to the PC board. Advanced constructors could use stripline techniques to replace the coaxes.

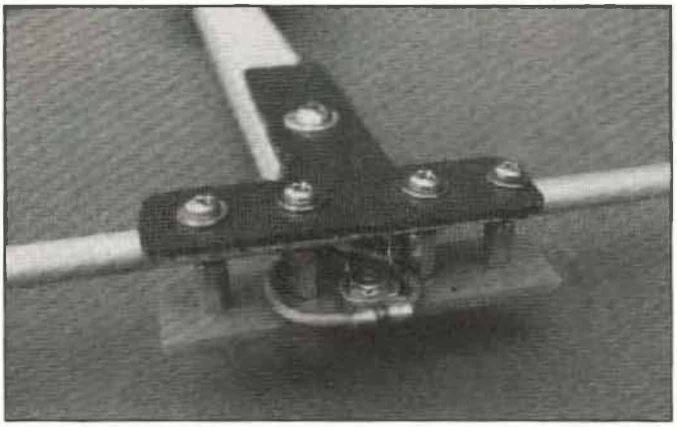

Photo D. This rugged mount keeps the dipole elements in place. Notice how the coax is supported with a lug to prevent stress on the solder connections.

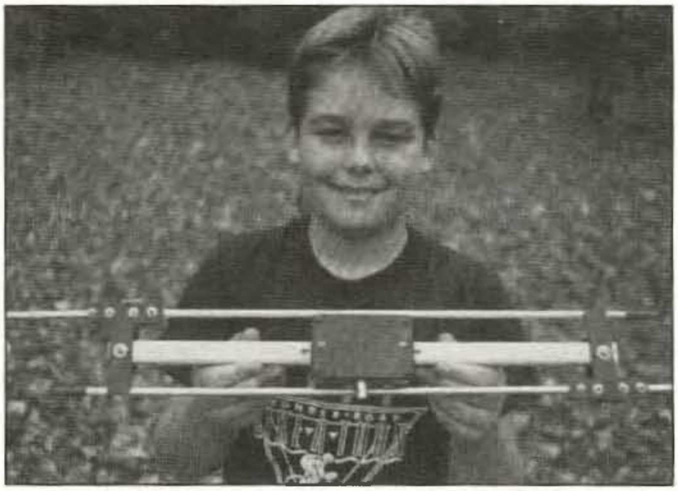

Photo E. The antenna folds up in seconds for easy transport.

ed, 5546 Cathedral Oaks Road, Santa Barbara CA 93111; 805-967-4859) sells decals, note pads, and jacket patches featuring a picture of a donkey being hoisted by a helicopter. The caption is: "We Save Yours." Get it?

Hams in search and rescue are often heroic T-hunters. But there are plenty of other ways to use RDF to help the public. In "Homing In" for January 1992, I wrote about hams in Arkansas tracking down a stuck public service transmitter. This month, I have two new incidents to report. If the present growth in T-hunting continues, our hobby may have a new kind of public service to brag about.

A Spooky Transmitter

The first item comes from Southern California. At about 3 p.m. on the day before Halloween, a signal appeared on the Verdugo TAC-1 frequency, which is used by the fire departments of Pasadena, Glendale, and Burbank. This intermittent carrier blocked out most other transmissions. The weak audio could only be described as "eerie."

Jami Smith KK6CU picks up the story: "I was called by Jack Haas KB6ZBS of the Los Angeles Sheriff Department. He knew I had a Doppler RDF set on my motorcycle." Jami, who is new to T-hunting but very enthusiastic, called veteran hunter Don Lewis KF6GQ, and they started the search.

Even though the stuck transmitter was near 154 MHz, KF6GQ found he could use his 2 meter mobile T-hunt beam to get bearings. "I was surprised how well it pointed in the right direction from my house," Don says. "All the way down the freeway it pointed in the right direction.

"When we got to Fair Oaks, the bearing shifted, and we ended up in front of the old abandoned fire department building. It still had antennas sprouting all over on top. Some firemen happened to be there at the time because in the old police station next door there was a haunted house, put on by a charitable organization.

"I couldn't get a good enough bearing at that point, so we got somebody to open the fire department building. But no radios were on there. I then went outside with the scanner, antenna off, and determined that the signal seemed to be coming from the old police building, where the haunted house was.

"Jami came out then with his little sniffer (similar to the W9DUU model), and it agreed with my police station bearings. But we were told we couldn't go in there. So we called the Pasadena Communications Coordinator to come down. He went into the building, went straight to the right room, and turned off the transmitter. It was VOX-controlled by a telephone, and somebody had knocked the receiver off the hook. The strange sounds on the audio were from the haunted house, of course."

Stealth T-Hunting

Heroic ham story number two comes from the Gulf Coast of Mississippi. It all started with a burglary at a Pascagoula communications equipment dealer on Sunday morning, November 17. Among the $10,000 worth of loot taken by a gang of youths were some VHF transceivers awaiting delivery to a shipyard.

That evening, a security guard reported unauthorized transmissions on his frequency. Soon other services, including police and fire channels, were targeted. "They were taunting the police on the radio," says Gary Fender W6SZX, who wrote me about the caper.

The Pascagoula Police contacted Chuck Bardsley KE5TL, a Navy antenna expert and regular T-hunter. The authorities suspected that the signals were coming from nearby Moss Point. They coordinated with the Naval Investigative Service (NIS) and the Moss Point Police Department (MPPD) to lay out a plan.

That night Chuck, Gary, Fred Wolf KE5SJ, and Ray Walker KB5FDW hooked up their RDF gear and met with the NIS agent and a ten-man team from the MPPD. Each T-hunter was accompanied by an armed detective carrying an 800 MHz frequency-hopping radio set. "There was concern that the thieves would see or hear us and quit transmitting," Gary said, "but the 800 MHz gear could not be heard on the thieves' scanners."

W6SZX continues: "After determining the general area of the transmissions, each T-hunt vehicle was assigned a hiding position around the suspected area. Unlike our regular T-hunts, the hunters had to be very inconspicuous. Driving around with rooftop quads and yagis was out of the question.

"We hid behind buildings and stadiums, and in schoolyards in the dark with the car doors closed and receiver audio low. I had a little hand-held yagi. I just held it outside the car and used a field-strength meter.

"At first there was no QRM from the thieves, but MPPD got a fire truck to use its siren for a few minutes to stir things up. The thieves' transmissions were very short, but with much patience we were able to get bearings.

"We were able to triangulate to one house from three directions, each about a block away. Based on that, the NIS and MPPD got a judge to issue a search warrant, and they went in. We were not allowed to go with them because of the danger. The crooks confessed right away and took the police to the stolen stuff."

Four suspects were under arrest by 2 a.m. Tuesday. The investigation continued, resulting in three more arrests by Wednesday night. All equipment was retrieved and prosecution is in progress.

These fellows get my vote for ham heroes! The *Mississippi Press* newspaper played it up by telling how "radio hams cooperated and were able to pinpoint the source of the transmissions." Gary says the best reward was when the police affectionately dubbed them "The Snoop Squad." 73

QRP

Number 20 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The QRP Argonaut II

The new Ten-Tec Argonaut II is now on the dealer's shelves. The Argonaut II adds a new dimension to low power amateur communication. (I was lucky enough to obtain an Argonaut II at last year's Dayton Hamvention).

If you have ever own or used one of the older Argonauts, you're in for a surprise! The Argonaut II has a completely new look and feel. It weighs in at 8 pounds, 10 ounces (3.91 kg.). Overall dimensions are 3-3/4" high by 9-3/4" wide by 12-1/2" inches deep. It's not going to fit inside a briefcase, which is why it's the first Ten-Tec radio with a handle on the side. The handle makes carrying the radio from place to place easy.

The Argonaut II's fully synthesized PLL design provides general coverage receive from 100 kHz to 30 MHz for CW, SSB, AM, and FM. It transmits in FM, but not AM. Dual VFOs are enjoyable for operating split frequencies on all ham bands from 80 through 10 meters.

Lots of Memory, but No Scanning

Of a total of 48 memory channels, 00–31 are simplex and hold only one frequency/mode setting. Memory channels 32–47 are duplex memories and hold the frequency and mode information for both VFO A and VFO B. A separate scratch pad memory can be used to hold temporary settings without affecting the nonvolatile RAM—a welcome feature. Because of the nonvolatile RAM, you won't lose the radio's memories when you turn off the rig or remove power. The clock, which is displayed to the right of the main frequency, continues to run when power is removed. A small user-serviceable 3-volt lithium battery maintains the clock memory.

Although the Argonaut II has 48 memories, you can't scan any of them. As a matter of fact, you can't scan anything! I don't find this to be a drawback, as I wonder just how many people scan the bands in real life anyway.

The Argonaut II features a large backlit LCD display. You can turn off the electro-luminescent back lighting via a top-mounted switch. The LCD is a pleasant green glow, clear with good contrast. For me, it could have been a bit brighter. As with most LCD displays, you'll lose contrast as you view the display from an angle. Straight-on viewing is best.

All the operating parameters are shown on the display. This includes the S-meter and RF power meter. They're one in the same, and are switched over between transmit and receive. The display can become rather busy when using the full QSK. If you spin the VFO knob at just the right speed, the LCD will display odd characters. Slow down or speed up, and it goes away. I called Ten-Tec and was told that the speed of the tuning knob, when It hits the speed of the multiplexing used by the LCD, shows only one segment at a time being displayed. This is normal.

When I first started using the Argonaut II, the built-in clock caught my eye. As time went by, I really enjoyed using this nice feature. When using the RIT control, the clock goes away and the display shows the RIT offset.

The main tuning control is smooth, and features variable tuning rates from 10 Hz to 500 Hz, selected with the FAST button and mode. The main tuning knob has a friction clutch to add extra drag. I found I liked the least amount of drag on the VFO knob.

There are two way to change frequency: via the keypad or the main

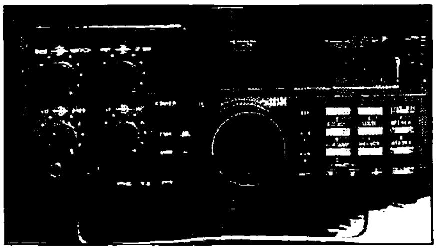

Photo. The Argonaut II is a great rig for QRP operation.

tuning knob. To use the keypad, you must key in the entire frequency. For example, if you want 14.023, that's exactly what you key in, including the decimal point. You can also call up a memory location instead of tuning up to the frequency you want. Space does not allow me to go into deep detail on programming the memories, or on the many different tuning features of the Argonaut II.

Power Requirements and Usage

Putting the Argonaut II on the air is simple. You need only add power, antenna, and key or microphone. Although Ten-Tec states "Energy efficient for practical battery operation," I found that you need a BIG battery to operate the Argonaut II any length of time. Ten-Tec specifies the current at 1.2 amps for receive and 3 amps for transmit. Using a Fluke 77 digital meter, I measured the current at 920 mA at 12.5 volts with no signal. By turning off the backlit LCD, I was only able to see 60 mA worth of energy savings.

If the supply voltage drops to 11 volts or under, the Argonaut II will fail to operate properly. In fact, the Argonaut II will do all kinds of strange things when the supply voltage is low. The review unit would allow me to transmit out of band! Yup! You name It, I could transmit there. Fixing the problem is a two-step procedure. First, return the supply voltage back up to 12.5 volts. Then do a soft microprocessor reset by depressing the CLEAR key while turning on the POWER switch.

During transmit, the Argonaut II demands 2.3 amps from the battery while supplying 5 watts of RF into a 50 ohm dummy load. On 40 meters, the current was a whopping 5.4 amps for 5 watts of RF. I don't know the reason for the extra current on 40 meters, and didn't touch base with Ten-Tec on this matter. The Argonaut II produced 5 watts across all the bands.

You can add the optional power attenuator for really low power. You get six calibrated steps from 5 watts to 10 mW.

Mode and Frequency Selection

Placing the Argonaut II on CW is simply a matter of selecting the mode and frequency. If you have the annunciator on, the radio sends CW when the mode is changed by selecting a "C" for CW, and either an "L" for lower sideband or a "U" for upper sideband. Of course, it's bells and whistles, but after a while I enjoyed using it. You can turn the annunciator off if you so desire.

There's a built-in VOX for SSB use. The Argonaut II has the new "soft touch" controls for setting the VOX gain, VOX delay, and anti-VOX operation. You can also set the sidetone level, but not the sidetone pitch with the soft touch keys. The sidetone pitch is internally set, and while you can change it, the tone is factory set for 700 Hz. The sidetone has dual functions: CW sidetone and spot tone. Changing the pitch of the sidetone will screw up the spot function.

The RF meter becomes an SWR meter when the FWD/SWR button is pressed. In the FWD position, the meter indicates output power with full scale equal to 5 watts output. In SWR position, the bar graph indicates reflected power. Below 2:1 SWR, the scale is expanded by blinking the bar graph segments. A perfect match is indicated when the last segment stays off continuously. It took some time to get use to this way of measuring SWR.

I did have some trouble with the key line. Some keyers I used wouldn't key the radio. The RF came on, but no sidetone was produced. Shorting out the KEY jack on the back of the Argonaut II produced sidetone and RF. My keyers use reed relays, not transistor switching, so there should be no problem keying to ground. I cured the problem by cleaning the plug and jack going to the Argonaut II from my keyer.

The Argonaut II continues with the famous Ten-Tec keying—fantastic! In fact, the keying sounds a bit better than my Argosy II. I also enjoy being able to slow down the QSK to semi-break-in keying. There is a small reed relay clicking on the chassis when keying. I used the Argonaut II for AMTOR, and it worked without missing a single letter. Packet operation was not tried.

The 8-Pole Filter

One very important new tool against QRM is the variable 8-pole crystal filter. You have an infinite choice of filters between 2.5 kHz and 500 Hz! If you're like me, sometimes the 500 Hz filter is too narrow, and the 1.8 kHz is too wide. Here you have a choice, and by tuning the bandwidth control, you can pick *exactly* the filter you require. Along with the IF passband tuning, the Argonaut II Is a real fighter in the crowded bands. There's an RF gain control and a -20 dB attenuator which help reduce front end overload caused by stations nearby. An audio notch filter rounds out the QRM tools. The notch filter works quite well, it's just a bit of a pain to adjust as the notch is very sharp. Slow tuning Is requiredl

When I don't feel like playing ham radio, I may feel like listening to the BBC on 5972 kHz. The Argonaut II provides AM reception with a 6 kHz ceramic filter. The variable bandwidth tuning is not available when receiving AM. The same is true for FM reception. The squelch for FM operation is internally set. You can turn the squelch on and off from a top mounted switch. The FM transmit deviation is preset and independent of the MIC gain.

The Receiving End

The receiver of the Argonaut II is very good. I'm impressed with the way It performed at Field Day. Operating on 40 CW with two other rigs on the same band, the Argonaut II knew the other CW station was (about 40 feet away) there, but I still made contacts. The phone operator, using an IC-735 on the same band, threw his hands in the air and took a walk.

There are some whopper birdies in the Argonaut II. You have to hunt for most of them, but some jump right into your arms. With an antenna connected, most birdies are under the noise level. The PLL noise can be heard, but I find the Argonaut II all and all a very quiet receiver. I don't have the means to measure PLL noise. I did notice I had to run the AF gain control almost three-fourths full for enough audio for me.

The Argonaut II has a noise blanker that really works. Mr. woodpecker *[an over-the-horizon backscatter system for detecting aircraft]* was not on, so I was unable to see if the noise blanker is effective on him.

One point I did not like with the receiver is the ability to copy both sides (from zero beat) of a CW station. The Argonaut II sounded very much like an expensive direct conversion rig! This condition only occurs on CW. When on SSB (upper or lower sideband), a CW note does not exhibit this problem. Seems you should move the passband to one side or the other to let the unwanted signal fall out of the filter. I tried this, and it works, but it wasn't in the manual as a solution. In defense of Ten-Tec, the manual is only an interim manual with the "real" one still in the computer at Ten-Tec.

All and all, the Argonaut II is a fine radio. It's not cheap, but then again, just how much do you think a radio like this should cost? Remember all those crystal filters you don't have to buy, thanks to the variable bandwidth 8-pole filter! The street price for the Argonaut II seems to be hanging around $1200.

The Argonaut II has some unfinished edges, but it has earned the right to be called an ARGONAUT! 73

Number 21 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Software Sources

In the past I have often mentioned this or that program or utility which can make an amateur's life easier. With the wide base of personal computers in the ham community, the probability of finding software that meets your needs is fairly high. Nevertheless, locating the source of that software is another matter.

Swapping with friends is probably the most direct way of obtaining the latest shareware or public domain offering. But the program you heard about may not be available locally, or you might not be able to pin down your friend for a copy. The question of "viruses" also enters into the picture when performing a personal swap.

The next step up the ladder to successfully locating your software is the local bulletin board system, or BBS. Here in the Baltimore area we have many such BBSs, several of which emphasize a particular machine or program type. Games, graphics, utilities, and even amateur radio, all have their proponents. Of course, most local machines are limited to one telephone line, so a long winded (busy-fingered?) caller can tie up the machine for hours. Also, the quality of the stuff online is often dependent on the perseverance of the system operator (SYSOP). It's a big job, and the files frequently fall into disrepair. Some boards charge, and some request uploads. Some boards are great, and others passable. Some are forgettable. I guess the old adage prevails: You pays yer money and takes yer choice.

CompuServe

On the national level, the pickings get better. In my opinion the biggest, most complete board is CompuServe (CIS). This massive data information service has just about everything you could want—for a price. Access CIS may be through a text based terminal, or a variety of "front ends." The CompuServe Information Manager (CIM) is CIS's proprietary terminal program that accesses the service through a windowing type environment. CompuServe is not cheap, but it is good. If you need some information, and are willing to pay for it, CIS is the answer.

To the best of my knowledge, all of the national data services screen all files available for download for the presence of viruses and trojans. While viruses should not be a problem, I'd still exercise caution with new files.

Delphi

Another national board I have spoken of is Delphi. Significantly smaller than CIS, Delphi boasts many forums, including a hobby forum that has a section for ham radio, and thousands of programs and information packets to download. Using a simple text-based interface, about any terminal program can dial into Delphi and find something of use.

America Online

This national online service distinguishes itself both by its interface and its cost effectiveness. The log-on screen of America Online will show you what I mean by a unique interface. America Online is built upon the Geoworks operating system. This is a graphical, windowing environment that is similar to, yet different from, Microsoft Windows. The program, which does require a graphics card, can be booted either from the DOS prompt, or run from a Geoworks system. It can also be run under Windows.

The terminal program installs easily from supplied floppy disks to a hard drive, configuring itself to the installed system. Installation is well behaved, with no wild rewriting of the AUTOEXEC.BAT or CONFIG.SYS files taking place. Once the program is installed, it dials out on an 800 toll-free number to locate current phone numbers for your area. You are asked to choose which number to call, and an alternate number as well. This information is stored in the program's configuration files, to be used as indicated.

Logging onto America Online is about as easy as clicking a mouse pointer and typing in your password. The America Online program does not store your password internally. Having entered the system, the welcome screen is displayed. Flags and icons tell you of new features and top news stories, and let you know whether you have E-mail waiting or not. Clicking on any of these icons will quickly take you to the desired feature.

Like many other large BBSs, America Online features many special interest groups, supporting a variety of topics. Computer and non-computer SIGs are present, ranging from education to religion, from aviation to amateur radio. Amateur radio? Yep, Figure 1 shows a screen from the Ham Radio SIG. Here, we are looking at the description of a file available for downloading that deals with computer control of Kenwood radios. Other available files are visible in the partially covered window to the right of the screen. In the Ham SIG are separate directories for IBM PC compatibles, and for Apple, Mac, and text files as well. A comparatively complete listing.

If you are going to pay for an online service, though, there has to be more than SIGs and program downloading. America Online comes through in this regard, with a full spectrum of games, some multi-player, in addition to news and reference material. The Grolier Online Encyclopedia is available for searches, and even contains information about ham radio.

Pricing for America Online is reasonable, with average hourly rates at around $5 an hour. I can't be more exact with the price, as the folks there tell me that they are in the process of reviewing and revising the price structure. Still, the overall cost is quite competitive, and remains on the low side of national online databases.

Getting On Line

Interested? About all it took to convince me that America Online was a valuable service was playing with it for a few hours. If you want to see for yourself, there are at least three ways you can gain access. The easiest way is to call them at 1-800-827-6364 and say you want to try the service. The next easiest way is to send in one of the cards or coupons bound into most of the computer magazines out there these days. Finally, if you send me your name, address, phone number, computer type, disk size, and all that other stuff, I will forward the information to America Online for you, and see that you receive a set of disks with all the information you need to try out America Online.

I've got more on tap for next month, and the pile of your letters is getting high enough that I may just devote a column or two answering questions, both simple and complex. Keep 'em coming! For now, you may reach me on CompuServe (75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR), as well as by mail at the above address.

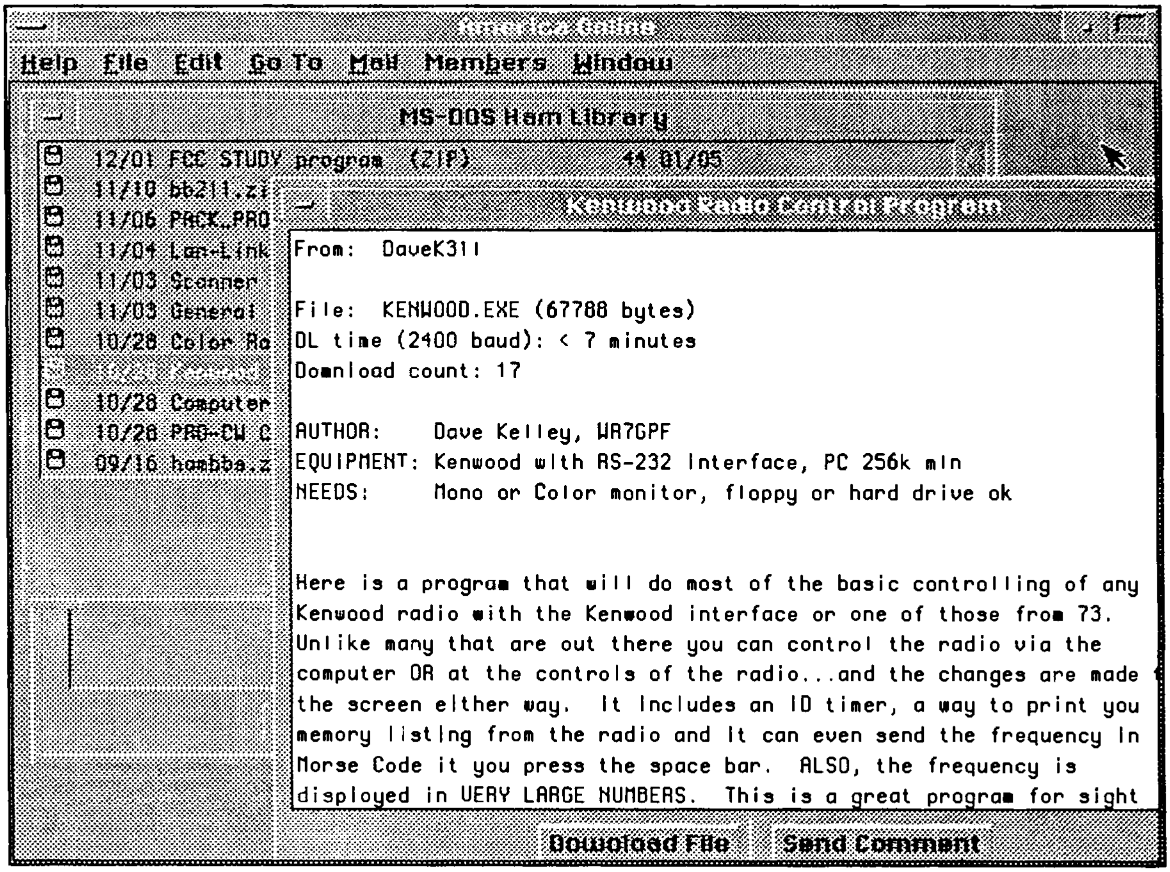

Figure 1. America Online's Ham Radio SIG. This screen describes a file on computer control for Kenwood transceivers.

Number 22 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Satellite Operation Resources

For new amateur satellite enthusiasts, finding information about the hamsats can be a problem. There never seems to be enough data to satisfy the appetites of newcomers. Fortunately, there are organizations around the world dedicated to hamsat programs, books covering the topic in depth, magazine columns, packet radio distribution of bulletins, standard telephone BBS systems with data, tracking programs, and satellite operational information resources.

Organizations

AMSAT-NA, the Radio Amateur Satellite Corporation of North America, is the best all-around source for current information on the amateur satellite program. Membership is $30 per year. This pays for the bi-monthly magazine and helps with the high cost of satellite design, construction, and associated launch expenses. The magazine, *The AMSAT Journal*, provides construction, software, and informative articles. To join, call (301) 589-6062, or write AMSAT, 850 Sligo Ave. #600, Silver Spring MD 20910. New members receive a membership certificate and a package of introductory material about the amateur satellite program. They also get discounts on all the many software products AMSAT sells for satellite tracking and telemetry decoding.

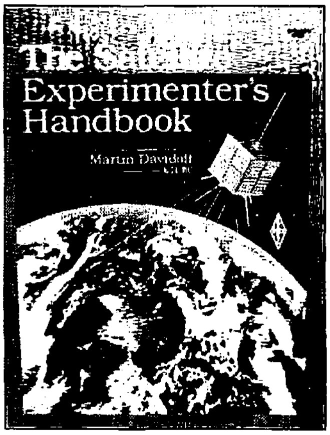

Photo A. Satellite Experimenter's Handbook *by Martin Davidoff K2UBC is available from AMSAT or the ARRL.*

AMSAT volunteers provide a weekly news service via packet radio bulletins, updating satellite activities and related topics. Orbital data for popular satellite tracking software is also available. The data and bulletins can be found on various terrestrial BBSs and via UoSAT-OSCAR-14 and the microsats. The AMSAT/DRIG (Dallas Remote Imaging Group) BBS at (214) 394-7438 is an excellent source of current information and data.

Project OSCAR provides a bi-monthly newsletter, "The OSCAR Letter." To subscribe, send a check for $10.00 made out to Project OSCAR, and mail it to "The OSCAR Letter" editor, Leonore Guimont KA6UCD, 5030 July St., San Diego, CA 92110-1112. Include six self-addressed-stamped envelopes (52 cents postage on each) with your callsign large and clear in the upper left-hand corner. Their publication typically runs 15 pages and contains information pertinent to California activities of Project OSCAR and related amateur satellite projects. To become a supporting member of the organization, send a check for $20.00 along with six address labels or addressed envelopes.

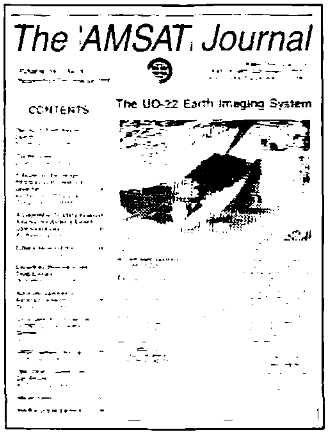

Photo B. The AMSAT Journal *is a bi-monthly publication for AMSAT members.*

AMSAT-UK, the Radio Amateur Satellite Organization of the United Kingdom, is another excellent source of input via their monthly magazine *OSCAR News*. A minimum donation of 19.25 pounds sterling per year (about $36) is required for North American members. They accept VISA and Mastercard, so payment is easy. From the U.S., the phone number is 1-011-44-989-6741 (UK business hours). FAX: 1-011-44-989-3430 (24 hours). The address is AMSAT-UK, the Secretary, 94 Herongate Road, Wanstead Park, London E12 5EQ, England, United Kingdom.

Several other AMSAT organizations around the world publish magazines and newsletters. AMSAT-DL in Germany has one of the largest, but it is in German. AMSAT Australia prints a newsletter for members, as does South Africa AMSAT, but the cost to receive these becomes prohibitive since they do not accept foreign currency or credit cards.

Newsletters

There are currently two independent newsletters published in the U.S. addressing the amateur satellite program: the "OSCAR Satellite Report" (OSR) and the "Satellite Operator." Both are available from R. Myers Communications, P.O. Box 17108, Fountain Hills AZ 85269-7108.

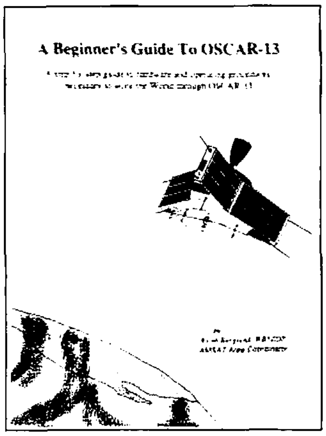

Photo C. A Beginner's Guide to OSCAR-13 *by Keith Berglund WB5ZDP is a valuable AMSAT publication with useful information on setting up and running a complete satellite station.*

OSR covers timely news items with its two-week publication schedule. Regular features include satellite orbital element sets, DX news, and satellite operating schedules. Other features and sometimes-controversial editorials also appear. The cost is $29.00 per year in the U.S., including first class mail delivery.

"Satellite Operator" is devoted to in-depth discussions on technical satellite topics and operational information, including weather FAX and NASA activities in addition to amateur satellite material. Publication is monthly for $33.00 per year via first class mail. When ordered together, OSR and "Satellite Operator" are $56.00 per year.

Columns

Most amateur-radio magazines have columns devoted to amateur satellite topics. This column has been a regular feature since January 1987. At least once a year, "73" also has a special satellite issue with a full range of articles devoted to OSCAR activity.

OST, World Radio, and *Spec-Com* provide regular columns about amateur satellites. *Popular Communications* has a column, "Satellite View" by Don Dickerson N9CUE, that often carries information on amateur activities.

The Radio Society of Great Britain provides a satellite column in its magazine *Radio Communications*, while *Practical Wireless*, also from the UK, has featured a satellite column by Pat Gowen G3IOR for several years. A few other foreign publications with amateur satellite columns include *Ham Radio Today* (UK) and *DUBUS* from Germany (English version).

Books

While there have been many books about satellites, only a few feature amateur radio satellites. Finding these books has been a problem for the new enthusiast trying to learn about AMSAT and the OSCARs.

The Satellite Experimenter's Handbook, an ARRL publication, is the most comprehensive guide to the hamsats. Every devoted satellite chaser should have a copy. This large-format softcover book by Martin Davidoff K2UBC can be purchased from AMSAT, the ARRL or at many radio stores *[also from "Uncle Wayne's Bookshelf"]* for $20.00. Topics covered range from the history of the amateur satellite program to orbital mechanics and antenna construction.

A Beginner's Guide to OSCAR-13 by Keith Berglund WB5ZDP is an AMSAT publication describing what it takes to get on the air with AMSAT-OSCAR-13, the most advanced amateur satellite in orbit today. Since its introduction in 1989, this publication has been a favorite for newcomers. The price is $7.00 from AMSAT.

The ARRL *Satellite Anthology* is a compilation of *QST* articles on amateur satellite operation and hardware. It brings together many of the best papers in one reference source and is $5.00 from AMSAT or the ARRL.

For those interested in satellite telemetry, *Decoding Telemetry from the Amateur Satellites* by G. Gould Smith WA4SXM is a good choice. Gould describes telemetry systems of past and current spacecraft complete with details on the various formats and conversion formulas encountered. This is another AMSAT publication and sells for $15.00.

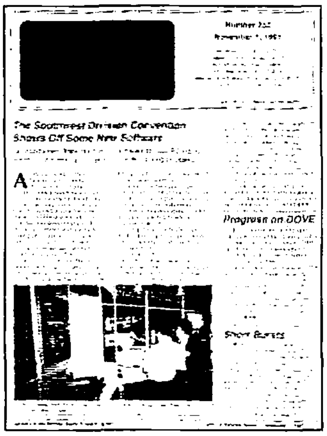

Photo D. "OSCAR Satellite Report" is a bi-weekly newsletter for satellite enthusiasts containing timely information on the amateur satellite program published by R. Myers Communications.

One of the newest AMSAT books is *The PACSAT Beginner's Guide*. It covers the basics on setting up and operating a packet satellite station. The original version of the guide did not include information on high speed 9600 bps operation via U-O-14, but it did thoroughly discuss 1200 bps activity through PACSAT-OSCAR-16 and LUSAT-OSCAR-19. For $10.00, the book includes PC software for satellite access on a 360K 5.25" disk.

OSCAR Satellite Revue by Dave Ingram K4TWJ is an anthology of *CO*

magazine articles from the 1980s. It also provides updates to those articles based on current information. Published by MFJ, this 43-page booklet can provide another point of view of the amateur satellite program. The price is less than $10.00 from most ham radio stores.

The *Space Radio Handbook* by John Branegan GM4IHJ is an RSGB publication. Published in 1991, this 242-page reference starts with space radio physics. Later chapters cover tracking methods, reception techniques, and many other topics through to the future of amateur radio in space and even lunar beacon systems. This new book is not easily found in the U.S., but inquiries can be sent to the Radio Society of Great Britain, Cranborne Road, Potters Bar, Herts EN6 3JE, England, United Kingdom.

Every year AMSAT hosts a space symposium. The proceedings of these gatherings are typically published by the ARRL. Copies can be obtained for $12.00 each for recent years. The latest, from the November 1991 symposium, makes excellent reading, and contains 258 pages of material ranging from S-band principles to South African satellite efforts. 73

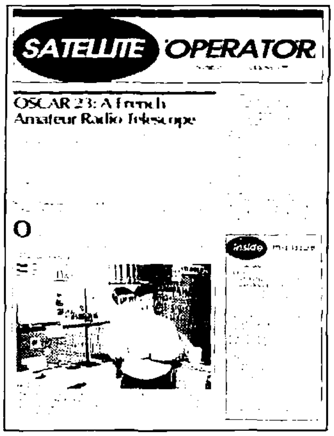

Photo E. "Satellite Operator" is a monthly publication from R. Myers Communications featuring articles of interest for satellite operators.

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525-4438, 8 data bits, 0 parity, 1 stop bit. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I am trying to locate schematics and/or a power supply for an old Collins KWM-1. *Bob Harwell AB4AV, 3005 Lakeshore Blvd., Saint Cloud FL 34769. (407) 957-7659 or (407) 843-8484.*

Fellow ham needs programming documentation for ICOM U-16 HT. Will pay for cost of duplication and postage. Can also accommodate file transfer through 2400 baud modem. Contact *Roy Holloway*, with price and method, at *(414) 927-5308*, or via *P.O. Box 436, Reeseville WI 53579-0436.*

I have a complete collection of *73* I'd like to find a new home for. *Dan Lester, Box 7606, Boise ID 83707-1606.*

I would like to hear from someone who can tell me how to connect my Yaesu FT-101E to the MFJ-211 Digi-Dial. This is a discontinued adapter which shows the operating frequency on a frequency counter. *Tony Stalnaker WA4LPJ, 2358 Old Al. Rd., Thomaston GA 30286.*

Wanted: Schematic and any other info on Model RAS-5 receiver and matching power supply (mfd. Jan. 7, 1943, contract number NXss20976). Thank you. *John Lovett KD4EUH, 2716 Gerald Ford Dr. East, Cordova TN 38018. (901) 388-8745.*

I am looking for a schematic or info on jumper placement for AC DC Electronics (Emerson) Model RE754B power supply. I will pay all cost. *Mary N1HFP, 28 Maywood Ln., Bristol CT 06010.*

We will help you to find friends among Russian radio amateurs who collect postage stamps, badges, color postcards, little models of ships, cars, airplanes, etc. We will publish bulletins with lists of collectors. Our bulletins will be sent to all who need our information or help. To be included in our bulletin, please send your name, callsign, address, and kind of collecting. *SASE to Val Sushkov, P.O. Box 3, Lipetsk 398000, Russia.*

Wanted: One copy of an *ARRL Handbook* dated between 1950 and 1965, for the purpose of educating a budding amateur in the field of tube gear. I will also consider any other texts pertaining to tube gear construction and repair. I will pay any reasonable costs and shipping charges. *James Hayes, 34 Treadway St., Ticonderoga NY 12883; or call (518) 585-6395 between 9 a.m.-8 p.m.* and leave a message.

Needed: Donation of 6 meter beam. Please mark "gift" on package and ship to *E.B. Martin, Box 113, Plymouth, Montserrat, Leeward Is., West Indies*

Needed: Donation of 6 meter amplifier (for 10 watt transmitter). Please mark "gift" on package and send to *Andre C. Sampaio PY0FF, P.O. Box 1, 53990, Fer. de Nahorna, P.E. via Brazil.*

Wanted: Schematics, service, or operation manuals, and/or any other info for HT "Azden PCS-300." I will pay reasonable copying/mailing costs. *Louis Vieiera-Belen KA7JHO, 5544 Balboa Arms Dr., San Diego CA 92117. (619) 565-9007.*

Wanted: Up-to-date address of Genave Company, originally of Indiannapolis; and/or schematic/manual for Model GMT-425 VHF 4 channel. I will pay postage. *Jim Gallardo, 1810 Westplain Dr., San Antonio TX 78227*

Wanted: A copy of the manual and/or parts for the Heath SB-620 Scanalyzer. *Bob Schlegel N7BH, 2302 286 St. East, Roy WA 98580.*

Number 24 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

Deadline for May classifieds is March 1, 1992.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. A-Z Electronic Repair, 3638 East, Indian School Rd., Phoenix AZ 85018. (602) 956-3024. BNB220

WANTED: Yaesu FT-23R-HT and pre-1980 microcomputers for museum. KK4WW. (703) 231-6478/763-3311. BNB234

FINALLY HEAR those unreadable signals buried in noise, heterodynes, tuner uppers. The **REVOLUTIONARY** new JPS audio filter NIR-10, digital signal processing, simple hook up, deep discounted $379.00 delivered! Authorized dealer: Davis RF Co. P.O. Box 230-S, Carlisle MA 01741. 24-HR. orders: (800) 484-4002, code 1356. BNB254

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IN DALLAS SINCE 1960 We feature Kenwood, ICOM, Yaesu, AEA, Butternut, Rohn, amateur publications, and a full line of accessories. Factory authorized Kenwood Service Center. Electronic Center, Inc., 2809 Ross Ave., Dallas TX 75201. (214) 969-1936. (800) 880-9400. BNB559

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RIG REPAIR by 20-year ham. Fast, reasonable. Skip Withrow, 5404 S. Walden Street, Aurora CO 80015. (303) 693-0997. BNB702

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WANTED: Manual for Panasonic 8-band shortwave double superheterodyne, Model # RF-2200. Call 716-247-5987. BNB704

JEHOVAH'S WITNESSES: Amateurs, SWLs please send full details, telephone number to: Bob Ellis, Post Office Box 7349, Winter Haven FL 33883-7349. BNB706

ROSS' $$$$ NEW March (ONLY): KENWOOD TS-850S $1,439.90, TL-922A $1,549.90, VFO-700S $149.90, TH-75A $379.99; ICOM 725 $715.00, R-71 $799.90, 471A $729.99; YAESU FT-703RTT $259.90, FT-1000 $2,675.00, FT-470 $388.00; MFJ 815B $44.90, 941E $99.90; AEA VSB-70 $309.90, PK64A/HFM $149.99, PK-88 $125.90, MP-20 $39.99; TEN-TEC 535 $1,129.90, 425 $2,599.90. ALL LIMITED TIME OFFER, CALL OR SEND 2 STAMPS FOR USED LIST AND MORE SPECIALS. LOOKING FOR SOMETHING NOT LISTED OR HARD TO FIND, CALL OR WRITE. Over 9000 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB707

EMERGENCY SUPPLIES: Disaster preparedness packs for your shack, auto, office, etc. Free catalog. Slates Products, P.O. Box 4375T, Walnut Creek CA 94596. BNB708

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TRANSISTORS RF FOR SALE: MRF454, MRF455, Series Toshiba 2SC2290, 2SC2873, and more. Looking for repair shops, dealers, and manufacturers. Call (201) 839-3360. BNB710

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ALUMINUM MAST OR BOOM MATERIAL 2"OD x 0.25" wall type 6061-T6. Strong, lightweight, cheap! SASE to: Doug/WS9W, Box 384, Stoughton WI 53589. BNB757

DIGITAL AUTOMATIC DISPLAYS. Kenwood, Yaesu, Collins, Drake, Atlas, etc. No bandswitching. Business, 52¢ SASE. Specify radio. GRAND, P.O.B 3377, Blaine WA 98230. Phone/FAX: (604) 530-4551. BNB758

WANTED: Ham equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Please look over whatever unwanted equipment you may have, and call us. We will pick up or arrange shipping. You will receive the tax deduction, but most important, the privilege of knowing that your gift really made a difference in the education and upbringing of a child. You are invited to check into the WB2JKJ CLASSROOM NET, 1200 UTC on 7.238 MHz or on 21.395 throughout the day. Hope to meet all of our friends at the DAYTON HAMVENTION in April. Write us at: The RC of JHS 22 NYC, INC., P.O. Box 1052, New York NY 10002. Round the clock HOTLINES: Voice (516) 674-4072, FAX (516) 674-9600. BNB762

ELIMINATE MULTIPLE NOISE TONES in your receiver audio output. The revolutionary new JPS noise filter, model #NF-60, Digital Signal Processing simple hook up to speaker jack. Unlike other Notch Filters, notches out multiple varying tones. **Deep Discounted:** $138.50 delivered continental U.S.! (Elsewhere $150.00 plus shipping.) Authorized JPS dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR orders: (800) 484-4002, code 1356. BNB763

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"HAMLOG" COMPUTER PROGRAM Full features. 18 modules. Auto-logs, 7-band WAS/DXCC. Apple, IBM, CP/M, KAYPRO, TANDY, C128 $24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

LAMBDA AMATEUR RADIO CLUB International amateur radio club for gay and lesbian hams. On-air skeds, monthly newsletter, and annual gathering at Dayton. (215) 978-LARC. P.O. Box 24810, Philadelphia PA 19130. BNB812

73 MAGAZINE INDEX 1960-1990. Book $15 or software $20. The world's largest (60,000 reference) amateur radio index 1909-1990. Software $85. OST, CO, HR, or RADCOM indices $10-$20. Write: DIDAH Publishing, P.O.B. 7368, Nashua NH 03060-7368. (603) 878-3628. BNB813

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WANTED:KEYER PADDLES. John N6HI, 4035 E. Lavender Lane, Phoenix AZ 85044 (602) 759-8019. BNB818

BUMPER STICKER (I'm a **HAM** when it comes to radio.) White on black, or black on white. Send $2.00 + SASE to N3IYR, 6080 Estes Court, Arvada CO 80004. BNB819

INEXPENSIVE HAM RADIO EQUIPMENT. Send postage stamp for list. Jim Brady—WA4DSO, 3037 Audrey Dr., Gastonia NC 28054. BNB890

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USED EPROMS!!! CLEANED AND ERASED 27C128—1, $3.25; 27C256—2, $3.75; 27512—2, $5.25; 27C010—2, $8.00. Satisfaction guaranteed!!! EPROMS, Dept. ST, P.O. Box 1931, Salem NH 03079. BNB905

INDIVIDUAL PHOTOFACT FOLDERS. Under #1400 $5.00. Others $7.00. Also Sams books. Allen Loeb, 414 Chestnut Lane, East Meadow NY 11554. (516) 481-4380. BNB906

NEW EIMAC TUBES (3-500Z) $129.95; new Penta Lab (3-500Z) $95.00; new Penta Lab (572B) $56.95. Send business-size SASE for complete line of amateur equipment and accessories. Lowest prices anywhere. D&K Electronics, P.O. Box 14456, Toledo OH 43614. (419) 893-0944. BNB911

HAVE ONE OF THE BEST generic echo box for your radio. Plans $5.00, no checks. Mike, P.O. Box 761247, Los Angeles CA 90076. BNB912

BATTERY PACK REBUILDING: SEND YOUR PACK / FAST SERVICE. ICOM: BP2/BP3/BP22 $18.95, BP5/BP8/BP23 $24.95, BP24/BP70 $26.95, BP7 $29.95. KENWOOD PB21 $14.95, PB21H/PB6 $19.95, PB25/26 $22.95, PB2/KNB3 $29.95. YAESU: FNB10/17 $22.95, FNB3/4/4A $34.95. UNIDEN APX650 $29.95, APX1200 $39.95; HEATH110 $26.95. "NEW PACKS" ICOM BP8(800 mAh) $39.95, (1000) $49.95, (1200) $54.95, BP83 $29.95, BP84 $42.95. YAESU: FNB2(500) $19.95, (600) $23.95, FNB10S (1000) $42.95, FNB12S(600) $46.95, FNB17(600) $31.95, FNB4SL(750) $44.95. SANTEC: 142/1200 $22.95. "U-DO-IT INSERTS" ICOM: BP3/BP22 $14.95, BP5 $20.95, BP8 $19.95. KENWOOD: PB21H/24 $14.95, PB25/26 $17.95. TEMPO/S $20.95. YAESU: FNB10 $14.95, FNB4/4A $26.95. AZDEN/300 $14.95. FREE CATALOG. $4.00 Shipping/order, PA+6%, VISA-M/C +$3.00. CUNARD, R.D. 6 BOX 104, Bedford PA 15522 (814) 623-7000. BNB913

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COMMODORE 64 in new slimline case including 2 disk drives, fastload cartridge, 300 baud modem, printer interface, video digitizer, mouse, joystick, GEOS, and lots of HAM software. $250 + shipping. Steve Kittelsen, 1711 S. 11th #134, Bozeman MT 59715. BNB916

COMMODORE 64 HAM PROGRAMS—8 disk sides over 200 Ham programs $16.95. 25¢ stamp gets unusual software catalog of Utilities, Games, Adult and British Disks. Home-Spun Software, Box 1064-BB, Estero FL 33928. BNB917

METSAT stand-alone satellite scan converter, Model 1700 in beautiful box. $300. Steve Kittelsen, 1711 S. 11th #134, Bozeman MT 59715. (406) 585-9433. BNB918

JOIN FAIRS—THE FOUNDATION FOR AMATEUR INTERNATIONAL RADIO SERVICE. FAIRS is hams dedicated to building international friendship by providing technical assistance, training, exchange visits, and equipment donations on a global basis. Free information: P.O. Box 341, Floyd VA 24091. (703) 763-3311/382-9099. BNB956

PRINTED CIRCUIT BOARDS for projects in *73, Ham Radio, QST, ARRL Handbook*. List SASE. FAR Circuits, 18N640 Field Ct., Dundee IL 60118. BNB966

SATELLITE MONTHLY AUDIO CODES 1-900-HOT SHOT IS NOW 1-900-SUMMONS. INTENDED FOR TESTING ONLY. $3.50 per call. BNB976

AZDEN SERVICE by former factory technician. Southern Technologies Amateur Radio, Inc., 10715 SW 190 St. #9, Miami FL 33157 (305) 238-3327. BNB979

COMMODORE 64 REPAIR Fast turn around. Southern Technologies Amateur Radio, 10715 SW 190th Street #9, Miami FL 33157. (305) 238-3327. BNB982

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QRP COMPONENTS Catalog, large SASE. KA7QJY Components, 944 N. 700 East #1, Logan UT 84321. BNB995

ROTOR PARTS ROTOR service, ROTOR accessories: Brak-D-Lays, Quik-Connects, Pre-Set mods. NEW models for sale. Free catalog. C.A.T.S., 7368 SR 105, Pemberville OH 43450. BNB996

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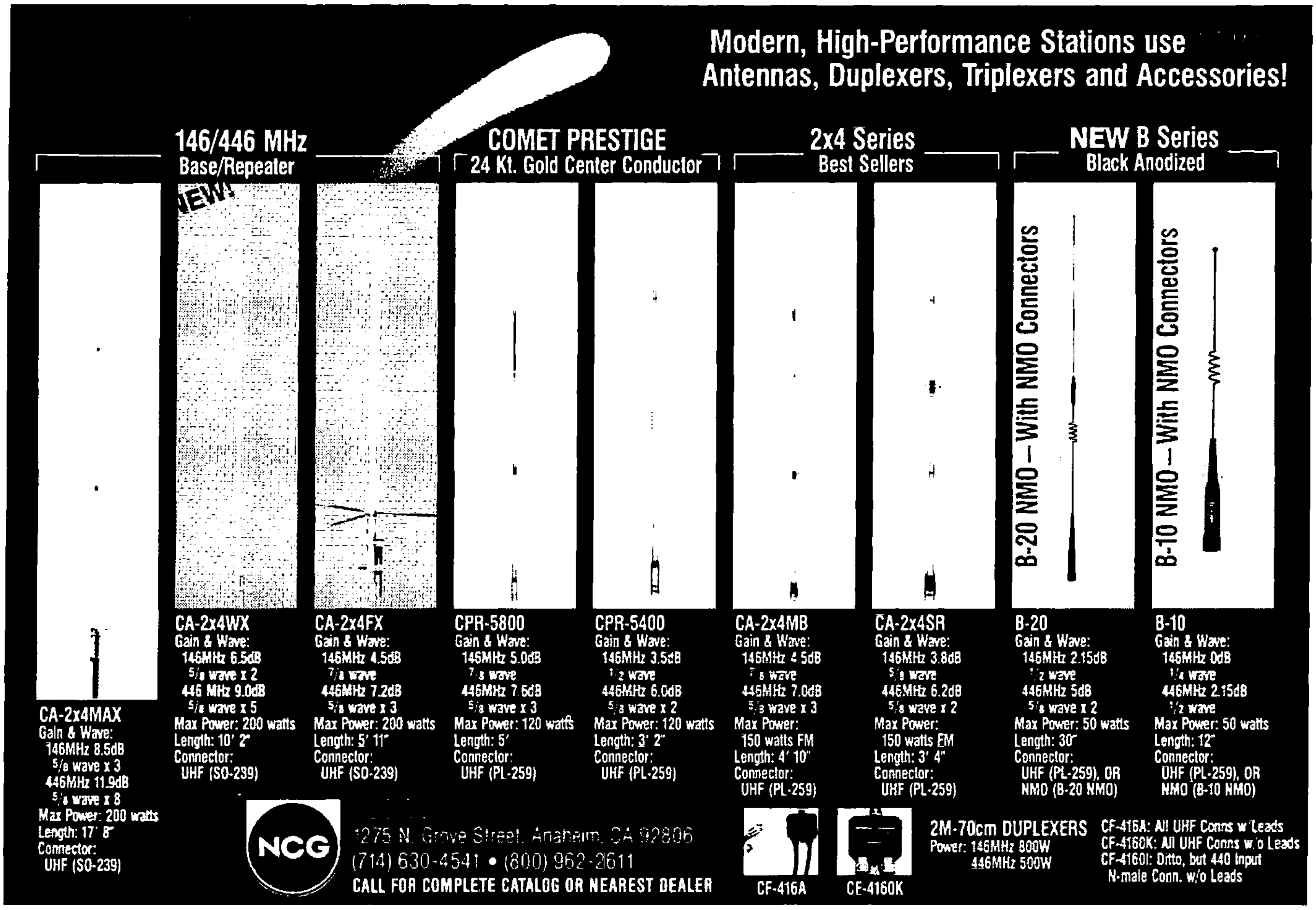

CIRCLE 54 ON READER SERVICE CARD

Above & Beyond

Continued from page 4

waveguide feeding the shack. Normal line of sight contacts on microwave, while the best possible, do not limit my home station. The old "line-of-sight rule" can be violated in some cases. What we take advantage of is the ability of microwave signals to reflect off of a targeted object. Microwave signals are highly directive and will reflect off of hills, buildings, water tanks, and the like.

The signals scatter much like a pool/snooker ball whose action, when hit, is to carom off the side rail of the table at a specific angle. Microwave energy is directed at objects in the same way. How perfect the focused reflection is depends on how perfect the surface of the object is. In most cases, objects reflect the microwave energy in a scattered signal at lower return levels.

Signals returned by the scattering method are by nature quite weak, but still detectable. Tests from my home to N6IZW's home (about five miles distant) are not possible on 10 GHz directly, even with high power and high gain antennas. However, when signals are reflected off a mountain to the northwest, we can communicate on 10 GHz SSB and narrow band FM. Both of our transmitters run between 5 to 10 watts, and signals at times are 15 to 20 over S-9.

A recent test involved mobile operation with N6IZW. We were able to hold mobile communications over a several-mile path. I had my antenna aimed at the same mountain northwest of my location, and N6IZW used an omni-slot antenna for transceiver operations. It worked quite well, even when in motion. Now, it was not studio quality, but it did provide somewhat better than marginal operations at times. Flutter and Doppler and all other effects were observed on the signals. VHF was used for linking up.

As another example, W2TTM and K2RIW Dick report bouncing signals off the 110 story World Trade Center (WTC) in New York City. W2TTM is 20 miles south of WTC-NY, running 200 mW. And Dick K2RIW is 35 miles east of WTC-NY, making for a 55-mile path. They have a sched on 10 GHz twice a week from both homes. Their stations are quite something. Dick has a two-foot dish at the 165-foot level of his tower, which also sports a 10 GHz beacon for the rest of the week.

W2TTM has a two-foot dish at 50 feet, and a 15-foot dish at 30 feet. The 15-foot dish has a 0.5 degree beamwidth and no elevation control yet. W2TTM reports that the 15-footer gets a 17 dB stronger signal than the two-footer. Sometimes it's the other way around; they think it's got something to do with the signal's elevation of arrival. On the light side, they might have turned the lights off or opened windows at the WTC-NY, shifting signals between antennas. It can get spooky at times.

Experimentation

You can observe the same effects on HF, but on microwave the demonstration can be carried out on a more tightly controlled model. Wavelength being smaller, experimentation can be carried out on top of a workbench. By having your test scaled down to manageable portions, it's no problem to put a gain antenna in your shirt pocket. Try that on 80 or 20 meters. With the entire antenna test range on the bench top, changes can be made rapidly, and a real grasp of the problems shortly becomes apparent. It's a very rapid educational process, right in front of you.

I don't want to undercut the popular application of wideband FM by promoting a shift to SSB, but rather present insight into other methods of operation. When I operate from the field I take both my wideband and SSB rigs and have a great deal of enjoyment with both of them. I have had many years of operation totally on wideband, and the shift to SSB was a gradual move towards adapting technology available via the surplus market to our amateur endeavors. (I waited till I could afford it.) Though the equipment is more costly, it seemed to be a natural progression on station improvements for 10 GHz operation.

PUFF—The Magic Software

This is not really a new product, but rather one that I did not fully examine when I first heard about it. I had been on the prowl for quite some time for a computer program that could generate microwave designs. Now there are several commercial programs available, but the cost is high. I recently discovered a program available from Cal Tech that does everything I could ask for. The program is called PUFF, a computer aided design program for microwave integrated circuits. To run PUFF you need an IBM PC, AT, PS/2, or compatible; a graphics card and display; and DOS 3.0 or later. Best performance is with a computer with 640 kilobytes of memory and a hard disk drive. A math co-processor will speed things up quite a bit, but is not required.

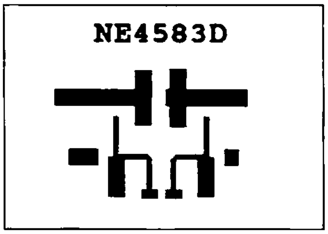

Figure 2. Laser printer sample of 10 GHz amplifier from trial test of amplifier construction. Scale 1:1.

The thing that makes this so exciting is that Cal Tech is making this program available postpaid (US) for $10 dollars. It comes with a manual to get you started. To not burden them with casual requests, don't order the program unless you are serious in applying the information they provide through this generous offer. PUFF is intended to be a serious educational tool for engineering students.

In the upcoming column, I will be going over PUFF and many applications that Kerry N6IZW and I have designed. Currently we are working on designs for amplifiers in the 5.6 and 10 GHz bands. The beauty of this is that you can customize a previous design for a specific device. All you need are the device's parameters to custom design a new layout. We encountered a few errors at the beginning, but our second cut at design produced excellent circuitry that worked quite well. The program can do the entire design from start to finish, producing a final artwork circuit board file.

We dumped the finished PUFF file to a laser printer for camera ready artwork. (Dot matrix is supported, but the quality is not as good, of course.) The thing to prove was how good PUFF computations were compared to our final measured construction. I am happy to report that the 10 GHz amplifier we constructed using PUFF worked great. We tweeked the first design up to the point of oscillation (18 dB gain at 10 GHz). Normalized output was very stable and predictable at the 10 to 12 dB gain range.

The second cut at PC board design produced a no-tune gain of 10 dB at 10 GHz on power up. I just finished cutting several new versions of the boards to test, and I've included a copy of a screen dump of the active working PUFF file titled NE4583D. See Figure 1 for details of the PUFF programming screen. Figure 2 is the laser printer copy of the PUFF output circuit board file for a low noise design for demo only.

This file was one of the first test plots of a design that had high peaked gain at our design frequency. Other designs gave less gain, but provided a very flat, broad response. I will cover the startup difficulties we experienced, and go through a complete design approach, including surface mount components (chip capacitors). Also, I'll cover the selection and cover differences between various components used in the construction of microwave amplifiers vs. low frequency chip components. The following month, I will get into the use of PUFF and some actual design methods that we used to construct working amplifiers. That should give you time to obtain a copy of PUFF so you can design a circuit for your own device. Order a copy of PUFF from Cal Tech. Cost is $10, foreign orders add $5 per item. Make checks payable to Cal Tech. Specify 5-1/4" or 3-1/2" diskette. Send your order to PUFF Distribution, Electrical Engineering, M/S 116-81, California Institute of Technology, Pasadena CA 91125.

As always, I will be glad to answer questions concerning microwave and related VHF/UHF topics. Please enclose an SASE for prompt reply. 73 Chuck WB6IGP

Number 27 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

My HF station is very modest. My main antenna is a homemade dipole, strung between a tree and the peak of the roof, with a two-conductor feedline. A low cost tuner allows me to get out a signal on 80 through 10 meters. I don't have any fancy amplifiers or processors. My signal is strictly barefoot.

I was scanning around the bands the other day when I heard the beginnings of a pile-up on 17 meters. Nothing too exotic, just Columbia. I'm not what you'd call a DX chaser. I keep track of the countries I've worked, but I don't bother with the OSL cards (unless the DX station needs New Hampshire, or my county) or any awards program. I know what I've worked, and that's enough for me.

I usually give it three or four tries, and if I haven't made contact by then I move on. I've read most of the books on DXing, so I'm familiar with most of the techniques, like waiting for the din to die down before transmitting my call or spotting the frequency of the last station worked.

Since I hadn't worked Columbia on 17 meters yet, I threw my call into the fray. A couple of "big guns" had moved into the pile-up, their high-powered, over-processed signals wiping out all other transmissions. Imagine my surprise when the DX came back to me—on my first try! No matter how rare or common the DX is, snagging him on the first try is truly one of the simple pleasures of amateur radio.

Later that afternoon, toward the high end of the same band, I came across a much larger and more frantic pile up. All the big guns were there, calling on top of each other, and calling on top of the DX station after he had already gone back to someone—chaos. It took me three or four minutes before I could get the DX station's callsign. It was South Africa. I didn't have South Africa on ANY band. It would be a totally new country for me, so I decided to try a few calls.

I listened for several minutes, trying to discern a pattern in how the DX was answering calls. He was only answering people on his frequency, so going a bit high or low wouldn't help. He didn't seem to be picking the last callsign heard in the din, so tail-ending wouldn't help. He also wasn't necessarily answering the loudest signals, so power wasn't going to help anybody. After listening to about a dozen contacts, I noticed that he wasn't ending his transmissions with the typical "73, thanks for the contact, QRZ." He was delaying his final transmission a bit, after the station he was working gave his name, QTH and signal report. He was listening for a callsign there. He'd then come back with "73, thanks for the contact, W1XYZ you're 5 and 8." Since most people started calling on top of him as soon as he said 73, they never knew that he wasn't even listening for a call when he unkeyed his mike. In fact, the person he was calling usually didn't hear him either, until the frantic shoutings of about a thousand other hams died down enough for the South African to repeat the transmission. Now that I knew his system, it was time to see if I could make the contact.

As soon as the station being worked said "over," I threw out a quick "November One Golf Papa Hotel." He came back with a "OSL five and nine. 73 and thanks . . ." That was all I heard, because as soon as he said "73," the pile-up started shouting. I didn't do anything except listen. As the noise died down, he came back loud and clear . . . "Golf Papa Hotel, you're five and nine, nice signal, over."

I didn't believe it! Snagged him! With only one transmission! Twice in one day! With about 90 watts and a dipole at about 20 feet! And I even got a "nice signal" from him!

I haven't related this story to demonstrate my prowess as a DXer. To be sure, this is the only time this has ever happened to me, and I don't expect it to happen again any time soon. I realize that luck had a lot to do with both contacts. After all, propagation has an awful lot to do with who a DX station can or cannot hear.

I've told you this story because my mail has been lately filled with letters from people who either complain about the high cost of hamming, or they complain about how Novices and anyone else with relatively modest stations can't work DX or contests. Poppycock!

Sure, you can't expect to pull the rare ones out of a pile-up on the first try. But you CAN expect to work them consistently if you use the two pieces of gear that cost you nothing—your eyes and your ears.

Have you read *The Complete DXer?* That, or any other book on DXing, will give you all the information you need. It never ceases to amaze me when I hear dozens of stations blindly calling a DX station without following even the most basic operating techniques (let alone the basic courtesy). It's not as if the information contained in these books is classified. If you haven't cast your eyes on any books about DXing, you're already placing yourself at a disadvantage.

It also amazes me when I hear stations calling in a pile-up who are obviously not listening to what's happening on the frequency. The DX station will say, "calls with a one only," or "calls ending in Bravo," and invariably there will be a handful of dummies who will not listen to what the DX is asking for. How many times have you heard a DX station start a QSO with someone, while three or four hams continue to send out their callsigns every three seconds? Like most things in life, you'll learn more if you spend more time listening than you do talking.

There's plenty of SSB DX on the Novice portion of 10 meters, and you don't need high power or a $10,000 station to work them. The other HF bands open to Novices are crawling with CW DX just waiting for you to work. A coupla' hundred bucks and a home-brew antenna is all it takes.

I have to admit, there's another reason why I told you the above story. I was so excited, I just HAD to tell someone! 73

Number 28 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson AZ 85541

Old Sol has fooled us again! It now appears that present sunspot Cycle 22 will exhibit a *double* peak before finally sliding to its nadir. A chart of smoothed sunspot numbers seems to indicate such a phenomenon. Looking at a chart of solar cycles from 1760 to the present, it appears that a double peak seems to occur on every even-numbered cycle *since* Cycle 12 (1878–1889), *but not before then*, all the way back to Cycle 1 (1754–1765)! Why this should be, I do not know—but it is interesting, to say the least!

March will provide some excellent worldwide DX on Good ("G") days (see the calendar) from dawn to after dark on the HF bands between 20 and 10 meters. More Poor ("P") days appear to occur during the first half of the month: that is, the 1st, 6th, and 7th, and the 12th and 13th. During the last half of the month, only the 23rd appears to be a Poor ("P") day. Your best DX opportunities are expected to take place between the 16th and 20th, and between the 25th and 31st. The rest will be Fair ("F"), trending either way.

On Good days, the HF bands will be open from dawn until after dark, and you can expect long and short path DX (particularly mornings and afternoons) as well as short skip within the U.S. and its neighbors to north and south.

Because thunderstorms begin at this time of year, the bands below 20 meters (30 through 160) will have to deal with atmospheric noise, but when they are quiet, good opportunities for DX, particularly during hours of darkness, will occur.

Use the charts to plan your DX work, and listen to WWV at 18 minutes after any hour for the solar-terrestrial report. The K index (indicator of magnetic field conditions) and the A index (indicator of signal absorption) should below, while the solar flux (indicator of ionospheric conditions) should be high for best operating conditions.

Interestingly, during those days marked Poor, you may also find other evidences of upsets in the atmosphere and in the earth. Check it out—just for fun!

By the way, during the equinoxes (equal night and day), grayline DXing seems to be at its best, and signals along the line of the terminator (path of darkness) are particularly good. Try it. See you next month. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	15/20	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U S S R	40	20/40	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	15/20	20

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	20	20	20	—	20(1)	20(1)	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20(1)	—	—	15(1)	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
ENGLAND	40	40/80	40	—	—	—	—	—	15*	15*	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15(1)	15/20	—	—	—	—	—	15/20	15(1)	—	—	—
JAPAN	15/20	15	20	20	20	—	20	20	—	—	—	15/20
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	15/20	15/20	10	10	10
PHILIPPINES	15/20	—	20	20	—	—	—	—	10/15	10/15	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	15/20	20
U.S.S.R	—	—	—	—	—	—	—	15(1)	15(1)	15(1)	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/20	20/40	20/40	—	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15(1)	20	—	—	—	—	—	15/20	15(1)	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/40	20/40	20/40(1)	(1)	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/40	20/40	20/40(1)	(1)	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R	20	—	—	—	20(1)	—	—	20(1)	20(1)	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

[illegible]

MARCH 1992

SUN	MON	TUE	WED	THU	FRI	SAT
1 P	2 P–F	3 F	4 F	5 F–P	6 P	7 P
8 P–F	9 F	10 F	11 F–P	12 P	13 P	14 P–F
15 F	16 F–G	17 G	18 G	19 G	20 G–F	21 F
22 F–P	23 P	24 P–F	25 F–G	26 G	27 G–F	28 G–F
29 G–F	30 F–G	31 G				

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

MAR 1

NORTHAMPTON, MA The MTARA Fleamarket will be held at Smith Vocational School starting at 9 AM. Handicap accessible. VEC Exams. Tables $12 in advance, $15 at the door. $3 admission fee; under 12 free. Talk-in on 146.94, 146.52, 223.82. Contact ***N1COR, 6 Laurel Terr., Westfield MA 01085; (413) 562-1027.***

MAR 7

DENVILLE, NJ The Split Rock/West Morris Hamtest will be held at Morris Catholic High School from 8 AM-2 PM. Talk-in on 146.985-, 146.52S, 223.860-, 447.075- (P.L. 88). Contact ***Bernie WB2YOK, (201) 584-5399.***

MAR 7-8

CHARLOTTE, NC The Mecklenburg ARS will sponsor the Charlotte Hamtest/ComputerFair at the Charlotte Merchandise Mart from 9 AM-5 PM Sat., and from 9 AM-2 PM Sun. VEC Exams by the Charlotte VEC on Sun. Advance tickets $6, $8 at the door. Children under 12 free. Tables $18 (in advance only). Write to ***Charlotte Hamfest, PO Box 221136, Charlotte NC 28222-1136,*** or call ***(704) 536-7373,*** for ticket and table info; ***(704) 568-7611*** for dealer and manufacturer info. Talk-in on W4BFB/r on 144.69/145.29.

MAR 12

CIRCLEVILLE, OH A Hamfest sponsored by the TEAYS ARC, will be held at the Pickaway County Fairgrounds from 8 AM-3 PM. Admission is $4 per person. Tables are $5 in advance, $6 at the door. Contact ***Dan Grant W8UCF, 22150 Smith Hulse Rd., Circleville OH 43113; (614) 477-3026.*** Talk-in on 147.78 and simplex 146.52.

MAR 14

CONNECTICUT The Annual RAS of Norwich Auction will be held at the Senior Citizens Center, Waterford Municipal Complex (Rt. 85, south of Exit 77 of I-395, or north of Exit 82 of I-95) from 10 AM until sold out. Setup at 9 AM. Free admission. Wheelchair accessible. Bring your equipment to be auctioned. Talk-in on 146.67 repeater. Contact ***KA1BB at (203) 739-8016.***

FLEMINGTON, NJ The Flemington Hamfest 1992, sponsored by the Cherryville Repeater Assn. II Inc., will be held at the Hunterdon Central High School Fieldhouse, Routes 31 and 523, from 8 AM-2 PM. Limited tailgating. Free parking. VE Exams. Wheelchair access. Vendor's tables $15 with quantity discount. Buyers admission $5. Unlicensed spouses and kids free. Talk-in on 147.375+. For reservations and info: ***Marty Grozinski NS2K, c/o CRA II, PO Box 308, Quakertown NJ 08868.*** Or call ***(908) 806-6944*** before 11 PM. For VE registration call ***Dick Wells KE2HQ, (908) 479-6395,*** before 11 PM.

HUDSON, NH The Interstate Repeater Society will sponsor a Fleamarket at the Lions Club Hall, Lions Ave., from 8 AM-3 PM. Free parking. Buyers admission $2, sellers $10/space. Talk-in on 146.85. Contact ***Wayne KA1MKH, (603) 895-9035.*** To reserve spaces, a check by Mar. 1 to ***IRS, PO Box 693, Derry NY 03038.***

TEXARKANA, TX The Four States ARC will host its 3rd annual Hamfest at the YWCA Bldg., 3410 Magnolia, from 8 AM-4 PM, rain or shine. Admission $2. Tables $5. Free Parking. VE Exams. Talk-in on 146.62. Contact ***Pat KG5SC, (903) 793-3677*** (eves.); or ***Travis K5AVH, (903) 792-2080.***

MAR 14-15

MIDLAND, TX The Midland ARC will hold their annual St. Patrick's Day Swapfest from 9 AM-5 PM Sat., and from 8 AM-2:30 PM Sun., at the Midland County Exhibit Bldg. located on E. Hwy 80. Advance tickets $5, $6 at the door. Tables $8. VE Exams at 12 noon on Sat. Contact ***MARC, PO Box 4401, Midland TX 79704***

MAR 20-22

SCOTTSDALE, AZ The Scottsdale ARC will host a 3-day No-Code Technician License class, presented by Loraine McCarty N6CIO. Pre-registration is required. Contact ***Loraine, (714) 979-CODE*** days; or ***(714) 556-4351*** eves./weekends.

MAR 21

SCOTTSDALE, AZ The A.R.C.A. Spring Hamfest, hosted by the Scottsdale ARC, will be held from 7 AM-4 PM at Scottsdale Community College (east parking lots), 9000 E. Chaparral Rd. Admission is $2 per car for general parking, or $5 per swap space. Overnight parking for self-contained RVs Fri. and Sat. VE Exams ($5.40 ARRL/VEC) at 10 AM. Walk-ins OK. Contact ***Walt N7IZM, (602) 947-0338*** or write to ***S.A.R.C. Hamtest, PO Box 10878, Scottsdale AZ 85271-0878.*** Part of proceeds will be donated to the Scottsdale Comm. College Scholarship Fund.

MARSHALL, MI The 31st Annual Michigan Crossroads Hamfest, co-sponsored by the Southern Michigan ARS and the Marshall High Photo Electronics Club, will be held at the Marshall High School from 8 AM-3 PM. Setup at 6 AM. Tickets $2 in advance (SASE), $3 at the door. Free parking. Tables: Min. 4 ft /$.75 per foot. Send payment with SASE to ***SMARS, PO Box 934, Battle Creek MI 49016*** or call ***Wes Cheney N8BDM, (616) 979-3433.*** Pre-register before Feb. 21 for License Exams (no walk-ins). Include 610 form, SASE and $5.25. Make check or MO payable to ARRL VEC and send to ***SMARS, PO Box 934, Battle Creek MI 49016.*** Exams start at 9:30 AM.

MAR 21-22

FORT WALTON BEACH, FL The Playground ARC will hold their 22nd annual Ham/Swapfest at the Ft. Walton Beach Fair Grounds from 8 AM-5 PM. Tables $10 one day/$15 both days; (call ***Len, WD4KKV, (904) 862-5771***) For RV parking with hookups and dump, call ***Tony KC4YBE, (904) 581-0156.*** For commercial space, meetings, forums, contact ***P.A.R.C., PO Box 873, Ft. Walton Beach FL 32549.***

MAR 22

BRISTOL, CT The Insurance City Repeater Club will hold its annual Hamfest/Computer Fleamarket from 9 AM-2 PM at the Bristol Eastern High School. General admission $3. Free parking. Prepaid tables $15; $20 at the door. Contact ***Chuck Motes K1DFS, 22 Woodside Ln., Plainville CT. (203) 747-6377.*** Talk-in on 146.88, 224.80. License Exams by pre-registration only. Write with SASE to ***ICRC, PO Box 165, Pleasant Valley CT 06063.***

BRAINTREE, MA The South Shore ARC will hold its annual indoor Fleamarket at the Viking Club, 410 Quincy Ave., from 10:30 AM-3 PM. Admission $1. Free parking. 8' tables for $12 each, includes 1 free admission per table if paid for before Mar. 18. Send payment to ***Thaire Bryant KA1MJR, 81 Saning Rd., N. Weymouth MA 02191.*** Tables cost $14 on fleamarket day. Make checks payable to the South Shore ARC.
For info call ***Thaire, (617) 331-3673,*** eves.

MADISON, OH The 14th Annual Lake County ARA Hamfest will be held at Madison High School from 8 AM-3 PM. Admission $4 in advance (SASE and postmark by Mar. 7 please); $4.50 at the door. VE Exams. A two meter indoor fox hunt will begin at 1 PM. 6' vendor tables are $6; 8' tables are $7.50. Talk-in on 147.81/.21 or 222.90/224.50 (PL 141.3). Contact ***Roxanne, LCARA Hamtest, 5777 Fenwood Ct., Mentor-on-the-Lake OH 44060. (216) 257-2036*** from 6 PM-9 PM and 10 AM-4 PM weekends or ***(216) 352-6756*** weekdays from 10 AM-4 PM.

MILTON-FREEWATER, OR The Walla Walla Valley ARC will sponsor a Swapfest at the Community Bldg. from 8 AM-4 PM. License Exams. Free admission. Indoor swap tables $5. Contact ***Carl Elsner N7PVW, (509) 522-1270.*** Talk-in on 147.28/.88.

JEFFERSON, WI The Tri-County ARC will hold its annual Hamfest at the Jefferson County Fairgrounds starting at 8 AM. Admission $4. 6' tables are $4 each. Monies will provide a scholarship to a second-year electronics student from the Tri-County area. Contact ***W9MQB, 213 Frederick St., Fort Atkinson WI 53538. (414) 563-6381*** eves.

STERLING, IL The Sterling-Rock Falls ARS 32nd annual Hamfest will be held at the Sterling High School Field House, 1608 4th Ave. Free parking. Areas for self-contained campers and RVs overnight. Tickets $3 in advance, $4 at the door. Tables, w/electricity, are $5 (bring your own cord). Talk-in on 146.25/.85 W9MEP repeater. Contact ***Sue Peters, Sterling-Rock Falls ARS, PO Box 521, Sterling IL 61081. (815) 625-9262.***

MAR 27

ELIZABETHTOWN, KY The Lincoln Trail ARC will hold their 13th annual Hamfest at Pritchard Community Center starting at 0800 AM. Setup at 6 PM. Advance tickets $4, $5 at the door. Advance reservations for fleamarket and new vendors will be $5 per table and chair ($10 the day of the Hamfest). VE Exams, walk-ins. Copy of license and original required. Exam contact: ***Chuck Strain AA4ZD, (502) 351-1715.*** Reservations contact: ***Whitey Hensley WD4GDA, PO Box 342, Vine Grove KY 40175. (502) 877-2234*** (day or night). Doors will open at 0800 AM the day of the Hamfest.

MAR 29

MONROEVILLE, PA The TRARC Hamfest/Computer Fest will be held at Expo Mart, RT 22, from 8 AM-4 PM. Admission $4 at the door. Children under 12 free with adult. Directions on 146.73. Talk-in on 146.52. Tables are $10 ea. Contact ***Jim AG3H, (412) 373-2536*** for tables.

MILFORD, CT All Class Exams by the Coastline Amateur ARA, will be held at the Fowler Bldg., 145 Bridgeport Ave., at 12 noon. Walk-ins welcome. Contact ***Gary NB1M, (203) 933-5125,*** or ***Dick WA1YOE, (203) 874-1014.***

MICHIGAN CITY, IN The Michigan City ARC, Inc. will hold their annual Spring Hamfest at Rogers High School, Pahs Rd., from 8 AM-2 PM (Central Standard Time). Setup at 7 AM. Admission $4 per person over 10 years of age. 8' tables $5 each. Electricity $2. Contact ***Roy Jackson NY9B, PO Box 2013, Michigan City IN 46360. (219) 872-4201.***

SPECIAL EVENT STATIONS

MAR 7

CENTRAL FLORIDA The Lake ARA will operate K4FC on 10, 15, and 20m at 28.365, 21.375 and 14.265 from 1200Z-2200Z, to celebrate their 40th Anniversary. For QSL, send QSL and SASE to ***LARA, PO Box 1465, Tavares FL 32778.***

MAR 10-16

ANGUILLA/BRITISH WEST INDIES Lambda ARC President Jim Kelly KK3K, of Philadelphia PA, and Vice President Don Bledsoe WB6LYI, of Long Beach CA, will begin the first OSCAR operation from VP2E (Anguilla) and VP2V (British West Indies). Don will begin from Anguilla as VP2E/WB6LYI during Mar. 10-13. Jim will operate as VP2V/KK3K from Tortola Mar. 13-16. These DX countries have not been on-the-air on OSCAR-13 before.

MAR 13-15

SWEETWATER, TX The Nolan County ARC will operate a Special Event Station from 1500Z-2400Z Mar. 13-15 during the world's largest rattlesnake round-up. Operation will be in the 20 and 40m General phone bands plus 10m Novice. For certificate, send QSL and large SASE to ***WR5B, PO Box 825, Sweetwater TX 79556.***

MAR 14

LUSBY, MD The Southern Patuxent ARC will operate N3IFL during 1300Z and 2100Z to commemorate Albert Einstein's birthday. Operation will be in the lower portion of the General phone bands and the Novice 10m subband. The theme is nuclear energy. Baltimore Gas and Electric Co. is sponsoring the event at their Calvert Cliffs Nuclear Power Plant Visitors Center, which is open to the public. Certificates will be awarded to each plant that contacts at least five other plants and submits a copy of their station log. For a commemorative OSL card, send a QSL and SASE to ***Bob Smith N3IFL, 12480 Catalina Dr., Lusby MD 20657. (410) 260-6908.***

MAR 14-15

DAYTON, OH For the third year, the Farout ARC will operate Station WB8SMC/8 from St. Patrick (Shelby County) OH during 1800Z 14 Mar.-1800Z 15 Mar. Operation will be in the lower portions of 80, 40, 15, 10m Novice CW and Novice phone; 20m General CW, and 80, 40, 20, 15m General phone, as band conditions allow. The Farout ARC QSLs 100 percent to amateurs and SWLs. To QSL, send a business-size SASE to ***Farout ARC, PO Box 9181, Dayton OH 45409-9181.***

MAR 21-22

CHESAPEAKE, VA The Chesapeake ARS will celebrate the 1st anniversary of the C.A.R.S. Radio Shack, by operating the Club Station from 1400Z Mar. 21-1400Z Mar. 22. CW: 28.125, 21.125, 14.050, 7.130, 3.680. Phone: 28.385, 21.240, 14.250, 7.230, 3.870± QRM. Send 8½ x 11½ SASE to ***C.A.R.S., PO Box 2035, Chesapeake VA 23327.***

MAR 24-26

HAWAII VOLCANO NATIONAL PARK The Chariton (Iowa) High School ARC will operate Jean (WH6DZ) and Paul (W3FO) Stoner's totally solar-powered station from 1800Z-2400Z in conjunction with their DXpedition to promote amateur radio in schools, and to study the volcanic origin of the islands. Operation will be in the Novice 10m phone subband. For QSL, send QSL and SASE to ***Lawrence Wantland II N0HTK, Chariton High School ARC, 501 N. Grand, Chariton IA 50049.***

MAR 27-28

PHILADELPHIA, PA Members of the Warminster ARC will operate WA3DFU 2200Z Mar. 27-2200Z Mar. 28, at the Union League of Philadelphia, to honor all the soldiers who fought in the Civil War. Look for WA3DFU on 14.275, 21.375 and 28.375. For a certificate, send QSL and SASE to ***Warminster ARC, Box 113, Warminster PA 18974.***

MAR 28-29

MISSISSIPPI STATE, MS The Mississippi State U. ARC will operate Station W5YD from 1800Z Mar. 28-0600 Mar. 29, to commemorate 100 years of engineering at Mississippi State U. Operation will be SSB in the General 40m and 20m and the Novice 10m subbands. For a certificate, send a QSL and SASE to ***W5YD, PO Box 591, Mississippi State MS 39762.***

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73 Amateur Radio Today

APRIL 1992
Issue #379

TABLE OF CONTENTS

FEATURES

Cover: "Little Hamshack on the Prairie."

The VHF/UHF contest station of Pete Sias WB0DRL in Salina, Kansas. Pete has a 28-foot dish on a 5-inch gun mount for 1296 MHz and antenna arrays for 6m–1296 MHz.

Cover photo by Pete Sias WB0DRL.

Plant your antenna. . . see page 18.

REVIEWS

DEPARTMENTS

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NEVER SAY DIE

Wayne Green W2NSD/1

How About Dayton?

We hams are attracted to Dayton every spring like lemmings to a cliff. It's an urge we can't explain. It's an ultimate wallow in the latest equipment . . . in the world's largest ham flea market . . . and a yearly gathering for each of the dozens of special interests which all together go to make up this weird hobby we call ham radio.

It's a place to meet and talk about MARS, microwaves, slow-scan, packet, amateur TV, meteor bounce, DXing, contesting, certificate hunting, RTTY, AMTOR. It's a place to see old friends again. It's a time to say hello to me and tell me you've been reading my baloney since my *CQ* days 37 years ago. Or do I remember meeting you at the airport in Karachi in 1959? Or that you've got my KC4AF card from Navassa in 1958.

It's a time to see what AEA has been up to in their labs . . . to see what Bob Heil has for you this year . . . to see the faces behind the ads . . . to meet and talk with our ham entrepreneurs . . . to look over Ramsey's new kits . . . to see MFJ's latest gear . . . to shop for software bargains and computer accessories. It's a madhouse. It's a funhouse . . . and the barbecue sandwiches are fabulous. It starts April 24th . . . will I be seeing you there?

As I mentioned last month, I've been wondering what I might talk about this year. My work with the New Hampshire Economic Development Commission has not just taken a lot of my time, it's forced me to give a lot of thought to what's been going on in America, not just in amateur radio or the music business. It's gotten me to think about how things have been changing and where it looks like they're going. It's had me polishing my crystal ball.

The Commission has been meeting every three or four weeks up in the state capitol in Concord. Despite my getting to the Consumer Electronic Show in Las Vegas in January and to the 17th Annual Ham Colloquium in Aspen (where the skiing was superb as Jim Brink N4NG and I zoomed down the well-groomed intermediate trails, while Chuck KO1I and Eric KV1J tackled the double diamond trails, finally landing Chuck in the hospital after a spectacular wipe-out).

The skiing was fun, but the conferences were serious. We particularly discussed the possible future of our hobby. With the old reasons for our being allowed to use our frequencies no longer valid, we agreed that either amateur radio had to reinvent itself or it would be pushed aside by commercial interests exploiting new technologies.

Some of us old-timers remember when new technologies were pioneered by hams. I remember talking with a young Jack Babkes W2GDG in his apartment in Brooklyn in 1946 about his narrowband FM concept. I quickly built an NBFM modulator into my Meissner Signal Shifter for use on 75m and another into an SCR-274N (ARC-5) for use on 20m.

I remember building my first RTTY unit in 1949. It had over a dozen tubes and filled a 2' 19" rack panel. It had auto-start and stop, automatic acknowledgment of message receipt, and so on. The teletype was an old Model 12 I bought from John Williams W2BFD, the father of ham RTTY.

John was a tinkerer. He built one of the very first telephone answering machines, which Ma Bell hated. He used a 78 record player to answer the phone and then recorded the messages on a wire recorder. All automatic. He also upset the FBI by building tiny transmitters which the Syrians used to bug the Israeli consular limousines.

Yes, there was a time when we more than paid our dues for the frequencies we were using. This investment really paid off the best during WWII when 80% of us went into the armed forces as radio ops and electronic technicians. My *USS Drum* crew reunion is just a week after Dayton this year. Amateurs contributed very significantly to our winning the war.

But that's a far cry from today. Our hobby ground almost to a halt in 1964 and has never really recovered. We did contribute in the early '70s when we pioneered repeaters and thus made cellular telephones possible. Would that have happened if I hadn't pushed repeaters so hard in *73*, with the *Repeater Bulletin*, and with symposiums? I don't think so, but then perhaps I'm exaggerating my part in all that . . . another old man's fantasy.

We no longer contribute technically trained people for possible use in the military. Our frequencies are no longer needed as a reserve for wartime use by the military. We no longer are at the cutting edge of technology. We are no longer doing much pioneering of new communication modes. Even our vaunted emergency communications services have faded. And let's not even pretend about international goodwill.

So we need to reinvent amateur radio and make it relevant in the 1990s. We haven't got a lot to start with. Some of our bands sound worse than anything I've ever heard on CB. Many of our clubs are run by old-timers who discourage newcomers. Ninety-nine percent of our school radio clubs disappeared in the '60s, so few modern-day kids have even heard of our hobby, much less are attracted to it.

Our only real national organization is in the hands of old CW men, few with any background in business or marketing. They fought the no-code license for years until finally forced to grudgingly accept it. They've promised more wonders than George Bush, and delivered nothing. They've let our bands turn into a mess. They've done almost nothing to promote our growth. Just as Washington is the seat of our country's problems, I see Newington as the heart of our sickness.

The Reinvention

Okay, I've gloomed and doomed you . . . now let's look at some of our potential strengths. We know that if America is going to regain its strength in manufacturing we're going to have to have a better educated work force. We also know that today that means technology, not doctors of philosophy. Well, we've got one of the hottest high-tech hobbies in the world.

With a little cleaning up and some serious marketing, we can get kids by the millions interested in learning about electronics and communications. They'll do it because it's fun! Unless we lose our microwave bands through disuse, we have more than enough room for 10 million new hams.

Once we get going with digital voice and computer communications, complete with time domain systems and data compacting techniques, we'll have plenty of room for everyone. But this stuff is child's play and we've been freezing out the children. When solid state came along I tried to publish every article I could get on it. The old-timers, still fondling their tubes, hated it. My articles were almost all written by kids.

When I started publishing computer circuits in the mid-'70s, my authors were kids. When I published *Byte* in 1975, my authors were mostly kids.

By getting rid of the kids in amateur radio 30 years ago we've managed to keep ourselves in a time warp. The League is still running its old CW traffic system . . . though there is a move afoot to update their name. Where did the "Relay League" come from? Well, in the very old days spark rigs couldn't be heard very far, so when the old-timers wanted to send messages any distance they had to be painstakingly relayed from one spark station to the next. Not much has changed in that aspect of the hobby. They're still busy copying messages and rekeying them over traffic nets. I wonder if echoes of W3CUL still haunt the 80m nets. She relayed millions of messages over the years.

I think it was around 1954 that I set up a RTTY station in a store on 42nd Street to handle Christmas messages to our troops. From there we sent them on 2m to relay stations on Long Island and then to our military in Europe. I made the "Brass Pounder's League" (BPL) in *QST* for a month with our traffic . . . without ever touching brass.

If we can bring the ARRL into the 1990s and get it going as an amateur radio marketing organization, we'll be well worth whatever billions of dollars in frequencies we need. We need to get kids by the millions enthused and busy learning about electronics and communications. We need to make it fun to learn.

Of course, that's the heart of the proposals I've made to the New Hampshire Economic Development Commission. I want to re-invent the New Hampshire educational system and turn it into a way for us to generate a high-tech work force. Remember, our present educational system was designed to turn out farmers and blue-collar factory workers, not engineers, technicians and scientists.

Are you going to be a passive bystander in all this or are you going to get busy and start making things happen in your area? Are you a "Joe Six-Pack" who doesn't read books or newspapers, doesn't vote and contributes nothing much to the world or America? Are you a couch potato? You know, it's surprisingly easy to make a difference.

Of course there's a danger here too. A pathetically high percentage of our activists are emotionally driven by some cause. They make a lot of noise and get on the evening news. Then, a while later, we find that their lack of knowledge about their cause has screwed things up for us.

We've had some excessively expensive legislation forced through by acid rain fanatics . . . and now we find their "facts" were wrong. If you've been reading the science magazines you know that our worries over automobile emissions have been way off-base.

Continued on page 90

QRX . . .

Mir News

On 17 March at 10:22 UTC a Soyuz module will lift off to take the next pair of Soviet replacement cosmonauts, plus a visiting German cosmonaut to *Mir*.

They should dock at 11:30 UTC on 19 March. All three have amateur radio callsigns, and the DL call will be either DP1MIR or DP2MIR. They will use 145.550 MHz simplex FM speech and packet radio as usual, plus a connected onboard digital speech system acting as a "repeater," which will listen for one minute and then replay the content back for one minute.

Sergei U5MIR, Alex U4MIR, and the visitor will return to Earth around 25/26 March, and UA3CR is suggesting to RSF that for posterity they retain their callsigns for terrestrial use, rather in the way that Ernst Krenkel UPØL2 did his. *TNX G3IOR, PAØDLO, W2RS, via Space News.*

Olympic Restrictions

The French pulled the plug on a part of the 2 meter band during the Olympic Games, and this move may possibly have a serious negative impact at the World Administrative Radio Conference and on other fronts as well.

According to DB2OS, a special bulletin from the REF (the French national radio society) states that during the 1992 Olympic Winter Games in Albertville, the 2 meter frequencies of 144.000–144.050 and 145.950–146.000 MHz were completely occupied by team members and service teams of some of the Winter Olympic Games' participating nations.

During all of February, any activity from ham stations in the French Departments of Ain, Haute-Savoie, Isere and Savoie were forbidden by order of the DRG and the amateur allocation in the sections of the 2 meter band listed above was suspended. The DRG (Direction de la Reglementation Generale) also noted that any violation of this regulation would have negative consequences between the DRG and the REF in future discussions.

According to DB2OS, this was far more than a national affair, as it was a violation by the DRG against the internationally accepted highly sensitive EME band and the equally delicate exclusive allocation for the Amateur Satellite Service, of which 145.95 MHz to 146.00 MHz are a major part. Such an action damages highly important activities internationally. DB2OS believes that this may be a reaction to criticism leveled at the French radio administration over the "SARA" amateur astronomy satellite improperly given an assignment in the Amateur Satellite Service. Nevertheless, DB2OS feels that a formal protest of this "flagrant action" by AMSAT, ARRL and the overall International Amateur Radio Union would seem to be in order. *TNX G3IOR, AMSAT-NA and Westlink Report No. 619.*

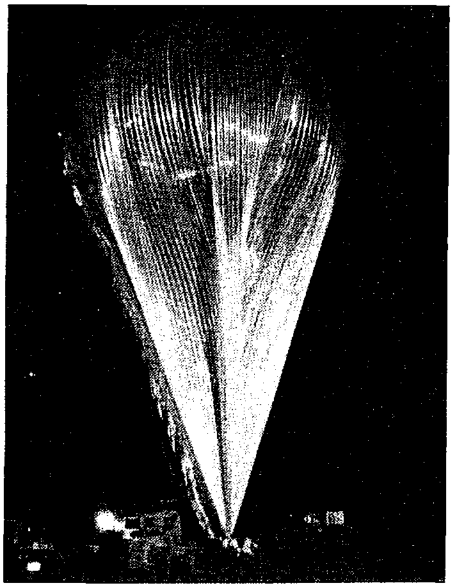


Photo. The massive 180-foot-tall Earthwinds balloon prepares for flight during the last launch attempt on February 22. Photo by Jon Pifer WM8W.

Earthwinds Delayed

The launch of the Earthwinds manned balloon flight has been delayed until next November. This flight will take three balloonists on a record-breaking non-stop journey around the world, while traveling with the jet stream at 35,000 feet in a pressurized gondola. They almost launched the massive two-balloon system early Saturday morning, February 22, from the Loral Airbase in Akron, Ohio. Unfortunately, the wind speed at ground level never became calm enough to completely assemble and launch the balloon system. The 180-foot-tall balloon is capable of lifting in excess of 20,000 pounds and contains over 300,000 cubic feet of helium.

Jet stream conditions as well as the weather around the world are not favorable for the flight after February. Therefore, the decision was made to delay the trip until next November when worldwide weather conditions give the crew their best chance at a successful circumnavigation of the globe.

The pilot of the balloon, Larry Newman KB7JGM, will activate the amateur radio experiment during the flight on a frequency of 28.303 MHz. Thanks to the efforts of Bob Rau N8IYD, Jud Nichols N8RXT, and Bill Brown WB8ELK, a voice telemetry system was designed to relay the balloon's latitude, longitude and ground speed, based on data obtained from the onboard GPS (Global Positioning Satellite) system. It will transmit the information at 15, 30, 45 and 55 minutes past each hour during the flight. Special thanks go to Mike Mouser, Jerry Knight and Loney Duncan of Rockwell International who integrated the telemetry package with the gondola's HF radio.

Antenna Patent

Ham-Pro Antennas of Sacramento, California, was recently granted patent #5,068,672 for the first major improvement in antenna matching in the past 50 years! The improved method of feeding antennas is called the balanced double gamma feed system.

The new invention feeds both sides of a grounded dipole through a non-frequency-sensitive balun which is part of the new feed loop. This balun is not obvious by examination, nor is it external. This loop is in series with the dipole. Its reactance is opposite that of the dipole, resulting in more than twice the best VSWR bandwidth found in conventional feeding methods.

Besides wider VSWR bandwidth, random radiation from the feed is eliminated, so forward gain is increased, and the front-to-side, as well as the front-to-back, ratios are greatly improved.

TVI and EMI are also reduced. Harmonic radiaton is down at least 30 dB. The very wide VSWR bandwidth makes it possible for the company to factory-tune their antennas, so no tuning of the feed is necessary. In fact, all their antennas are pre-tuned, weather-proofed, and sealed at the factory after VSWR tests.

Ham-Pro manufactures a complete line of amateur monobanders using this patented system. More information may be obtained by contacting Peter Onnigian at Ham-Pro, 6199 Warehouse Way, Sacramento CA 95826; (800) 879-7569.

The Greening of *73*

Subscribers will notice that starting with this issue, *73 Amateur Radio Today* will be arriving without the plastic wrapping (called a "polybag"). After researching the matter, we decided that the minimal protection offered by the polybag did not justify the negative environmental impact of its use. We hope our readers will support this move toward a "greener" planet.

TNX...

. . . to all our contributors! You can reach us by phone at (603) 525-4201, or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 525-4438 (300–2400 bps), 8 data bits, no parity, one stop bit. You can also send news items by FAX at (603) 525-4423.

Number 3 on your Feedback card

LETTERS

From the Hamshack

Denis Catalano WD4KXB, Woodbridge VA Wayne is always saying, "go do it"—go on a DXpedition. So we did. KJ4VG and I drove 22 hours to put Zone 2 on the air during the C&WW phone contest. We made over 3,000 QSOs, and loved it.

John Wiesenmeyer NXØT, ex-WN9HFA, WA9PLV, Divernon IL All of the editorials in the December 1991 issue of *73 Amateur Radio Today* are worthy of note. Since you don't have much time to read lots of trivial fan mail, I'll get to the item of singular importance.

Your mention of the FCC establishing some sort of fee to allow the handling of requested callsigns is a SPECTACULAR IDEA!!! Sir, this callsign business, from where I view the matter, has become a deplorable situation. Who would ever have dreamed our callsign system could become such a hodge-podge mess? Dr. Green, I'd pay CONSIDERABLY MORE THAN FIFTY DOLLARS to get rid of my present idiotic callsign, in exchange for WA9HFA, (never issued, by the way), which I would have received had I upgraded from Novice (WN9HFA) before my ticket expired in 1964. If not that, ANY traditional W9 or WA9 callsign.

Any muscle you can throw at this effort would seem a great service to our hobby. I would pay PLENTY, whatever the FCC wants, to allow me to again hold a traditional ham callsign. I wouldn't bat an eye to spend several hundred dollars to unload this bogus callsign of NXØT, either up-front or as bribe money. Wouldn't matter to me one way or the other. And you would be surprised, sir: I'm far from being the Lone Ranger with this view, as you surely realize as well. 300,000 hams furnishing a $100 application for a special callsign request would net the FCC no less than THIRTY MILLION DOLLARS. If they can't issue special request callsigns with that sort of revenue, then there is something seriously wrong with the methods and the thinking of the FCC directors.

I hope you can continue to press this issue in *73*, and encourage your readers to pester the hell out of the FCC to straighten out this blithering mess.

Thank you for listening to my views.

Kenneth A. Stevens KN2A, San Jose CA For a few months there have been many comments concerning the QRM on weekends because of contest operations. Years ago I wrote to the ARRL suggesting a few procedures that might help lessen the problem. I even enclosed an SASE to get their response. The VIPs did not agree so they, as usual, did not take the time to respond. I have discussed this QRM problem over and off the air with many hams and have yet to find one who doesn't agree that the following ideas would work.

All-mode contests should not run for the full weekend. Many hams work all week and the only time they can talk to friends or family, if across the country, is on HF. Unless they have a linear, beam, etc., they cannot compete. If a contest were limited-mode, they could run phone during a CW test and CW during the phone test. On phone contests the frequencies of operation could be the bottom 50 kHz of the General class, and the top 50 kHz of the Advanced class band. This would give the non-contesters an area to enjoy other ham activities. The top edge and bottom edge of the contest frequency operation could be monitored by official observers. Any contester who was found operating outside of the assigned area would be penalized or disqualified from the contest. This would give the ØØs some practice and experience. It might cut down on some of the big boys running excessive power, overmodulating and spilling outside of band edges.

I would like to hear comments from those who disagree. I feel it is time we all give others the consideration that we feel we are entitled to. I have read so many times that we should tune up on a dummy load. I must ask, how can anyone match an antenna without using a tuner and putting out a carrier to do it? Yes, we can roughly set the tuner on strong receive. Or we can invest in a noise bridge, etc. But usually the carrier is the final answer. I do feel, however, that knowing where your carrier is going to be is the best answer. There is no accepted standard by manufacturers as to where the carrier is in relation to the receive frequency. The old tube rigs would offset the carrier on tune or CW above a USB listening frequency, some below a LSB frequency. On some of the later solid-state rigs on USB or LSB, the listening frequency is also the carrier frequency. If you shift to CW, your carrier is your readout and you then are listening about 800 Hz up or down from that. The advantage is that whether you are listening to an upper or lower sideband, your carrier is zero beat and will not be heard.

For the above reasons, I say, "Do not tell a person to find a clear frequency to tune up." If you do, they will put their carrier above or below a going QSO and interfere. If they learn where their carrier is, they can put it zero beat with the QSO they intend to join and apologize later if they were a few cycles of zero.

I've heard many hams complain that they have tried to break into a lower sideband phone net with a CW signal. They claim the net control cannot read CW, should not have a license, etc. Those fellows had tube rigs that shifted to USB listening on CW. The rig transmitted 800 Hz up. So the carrier was on net controls upper sideband and not heard. The new rigs would also not be heard if they zero beat the listening frequency.

Well, I've unloaded my gripes. I know I talk too much. Hi! I enjoy *73 Magazine*. I read *73*, *CQ*, and *QST*. I find *73* the best. *CQ* has too many contests; *QST*, too much emphasis on contest and traffic self-praise. I dropped membership in the ARRL years ago because they do not represent the amateur membership. They are a money-making business. I agree with Wayne nearly 100%.

Glen A. Bizeau VE1GAB, Saint John NB Canada I keep hearing you complain about how hams are never doing anything but talking. Well, I have a surprise for you.

Six months before I got my ticket, I was over at a friend's house, Bob Meade VE1BDI, and we were talking about how Nova Scotia had such a nice linking system covering most of the province and some of Prince Edward Island. We in New Brunswick were lucky to have a decent 2 meter repeater.

After I got my ticket I decided that this one ham was going to make his new-found hobby worth the nights of studying. With the help of Bob VE1BDI, Glenn VE1GMM, Brian VE1BTC and a few other guys, we were able to make this a success. I bought the equipment and a duplexer, Glenn lent us his power supply and his time, and Brian found us a good site.

Thanks to a local radio/television station we were able to put our new-found baby on the highest hill in southern New Brunswick.

Mt. Champlain reaches up 1462′ and our antenna is up a tower at the 1500′ level. The repeater, soon to be a hub, is wdrking pretty well. We're putting out 20 watts on 443.500 (+) and can be heard over 90 miles away. We have a few minor problems of RF sneaking into the receiver, but what do you expect from a site with a 1,000,000 + watts of RF floating around? All in all, the machine works well. Soon we will be linking a few major cities into the hub and maybe we'll even get linked into WA1KAH's Patato Head Network. Then we could talk to you through the system, Wayne. Wouldn't that be fun!

P.S. I was wondering why you never mentioned anything about the night a few fellows down here talked to WB8ELK while he was in your shack on a fine evening in the spring of '91. That was one heck of a tropo duct.

Glen, it certainly was a good opening (over 300 miles). Looking forward to our next tropo contact.—Bill WB8ELK

Russ Thomas WI9B Effingham IL A Buchanan/Green ticket in '92 has my full support.

I refuse to run. If elected, I refuse to serve.—Wayne

Alfred Holden KM4TN, Greenville SC Wayne, I have been a ham for about two years now (KM4TN) and find I have a problem. Since the first thing I read in your magazine is your editorial, I pretty well know your stand on the League. My question is: Should I just bail out and quit, or should I try to change it from the inside? I'm 29 years old, make my living as a two-way service technician and find that I play guitar more than I fool with these ham radios.

Alfred, there's no known way to change the League from inside, so all you have to do is decide whether you want to subscribe to QST *or not.—Wayne*

Eric Jorgensen KE6US, ex-K1DCK, Riverside CA I just received a renewal notice which, as usual, is more confrontational than persuasive. In the letter you mention that there has been "almost no growth in the last 10 years" and that "amateur radio has been getting by on its past glory." One of your solutions is to try "other ham modes such as RTTY, AMTOR [sic] or packet." I got news for you, Wayne. All of those came into their own in the last 10 years. Even RTTY, which has been around for a long time, really didn't advance beyond the work of a few '60s diehards (including me) until the advent of home computers.

I have enjoyed the excitement of amateur radio for 35 years. I still find it as exciting now as 25 years ago—maybe more so because of all the innovations in the last several years. I sure don't see that excitement reflected in the pages of YOUR magazine. Instead, we have a few simplistic construction articles, a couple of very good columnists, and the endless ramblings of a tired old man. This might explain why the "magazine" looks more like a pamphlet these days.

Incidentally, I worked you 25 or 30 years ago on RTTY, and our QSO consisted of you sending me an interminable brag tape about an action-packed DXpedition who-remembers-where. Now I get a form letter about the same trip. What have YOU done lately for ham radio? I'll take a live QSO complete with rig and WX info anytime to a canned travelogue from a ham personality.

Your whole magazine is about YOU, not ham radio. There is more in any given issue about how easy it is to earn money in audio CD publishing than about any single ham topic. I would bet your staff sends out resumes every time you catch a cold. In the words of Sam Goldwyn, "Count me out."

John C. Watfins N8JZH, Miamisburg OH I am a subscriber to *73* and really enjoy reading your magazine. I find that it is really informative, rather than just lists of contests and DX requests.

Many of your articles on radios and equipment are valuable, and the reports are useful to those of us who purchase "used" equipment. 73

The Arrow Antenna

Hit the bull's-eye with this portable VHF sharp shooter.

by Mike Walker KA0VFF and Al Lowe N0IMW

How would you like a completely portable, 4-element 2 meter antenna that fits into its own 1" x 1" x 48" boom? Not only does it fit inside its boom, but it can be assembled in approximately two minutes. I'll just bet you are quivering with excitement! Calm down and reach for a quiver of aluminum arrows. Aluminum arrows are the secret to the versatility and exceptional gain characteristics of the Arrow Antenna.

Photo A. The Arrow Antenna.

This antenna has proven to be very versatile. While hiking in the Rocky Mountain National Park, I used my antenna as a walking stick. During rest stops it was just a matter of pouring out the boom contents, taking a couple of minutes for assembly time, and I was on the air! In an emergency, this antenna is ideal. It will store easily in the trunk of your car, ready for any situation. Another advantage of the antenna is that it is not prone to damage because its contents are protected by the boom.

Foxhunting activities can be stressful to your antenna, especially during the heat of the chase. Your Arrow Antenna will be able to withstand lots of abuse, even when your partner drives under low-hanging tree limbs.

At every public service event, it seems like the check point assignments are in the worst possible locations. The Arrow Antenna will help you shoot your way out of those places where a rubber duck and an HT would not be sufficient. If you need antenna gain, portability, and a rugged antenna, then read on.

Another unique aspect of the Arrow Antenna is the gamma match. Al Lowe N0IMW is to be credited with the design of the gamma match. The gamma match makes the Arrow Antenna all the more portable. Al spent several long evenings fabricating prototypes of the gamma match before finalizing the design. When you start construction of this antenna, I am sure you will appreciate the cleverness of Al's design.

Construction

To begin construction of the Arrow Antenna you have the option of using our measurements, or to custom design your antenna for a specific frequency. Our design is not new. It is basically a copy of the standard NBS (now called the National Institute of Standards and Technology), with some variations. Our Arrow Antenna dimensions are calculated for a center frequency of 146.520 MHz. It is fairly broad-banded, having been tuned out of band for use in area search and rescue communication around 143 MHz and 149 MHz.

The materials for the antenna are readily available. If you are handy with a drill press and a hacksaw, you will have no problem building and assembling this antenna. See the Parts List for the materials needed.

Using a drill press for construction of this antenna will enhance the overall performance of your antenna. The mechanical integrity of your antenna will be a natural progression because the drill press will inherently keep all your elements parallel and perpendicular.

For our purposes, antenna performance dictated the selection of a 48" boom. Measuring from each end of the boom material, lay out the reflector element, and the second director element at 1" from the end of the boom. Mount all elements in the center of the boom width. Place the driven element 15-5/16" inches from your first mark, or 16-5/16" from the end of the boom. The spacing is slightly less than 0.2 wavelengths. In a like manner, lay out the positions for the first director. The driven element and the first director will be spaced at approximately 15-5/16" in the center of the boom. Now you have established all of your element locations (see Figure 4). At each of the element locations, drill a through-hole 11/64" in diameter for a #8-32 threaded rod.

Using the reflector as the reference for the rear of the antenna, move up to the driven element #8-32 hole location and establish the hole location for the PL259 bulkhead connector exactly 1" on center forward from the driven element, or 17-5/16" from the rear of the boom. The bulkhead connector requires a 5/8" through-hole. You should now have holes drilled for each of the elements, and the hole for gamma match and coax connections along the boom (see Figure 2). The desired polarization of your antenna will determine the location of the U-clamp. During our fabrication of the Arrow Antenna we placed the U-clamp at the balance point of the antenna. If you use the antenna in the vertical position it is imperative that the gamma match be above the boom and the coax run along the boom to the mast. If the coax is parallel, close to the driven element, antenna performance will suffer.

Each of the following measurements will be used to establish element lengths. Using a tubing cutter, scribe the outside of each element at the desired length. Grasping the element on either side of the scribe mark, you

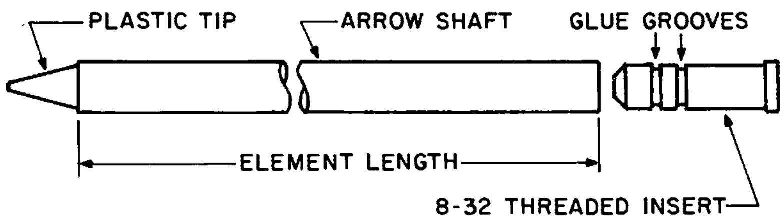


Figure 1. The aluminum arrow element.

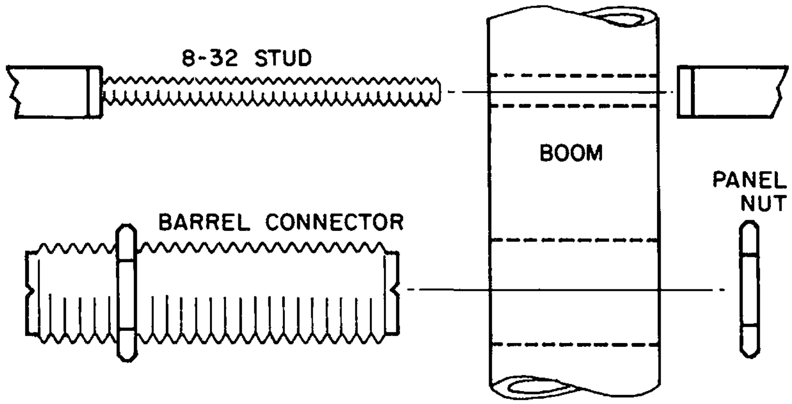


Figure 2. Attaching the elements to the boom. The feedpoint connection is also shown.

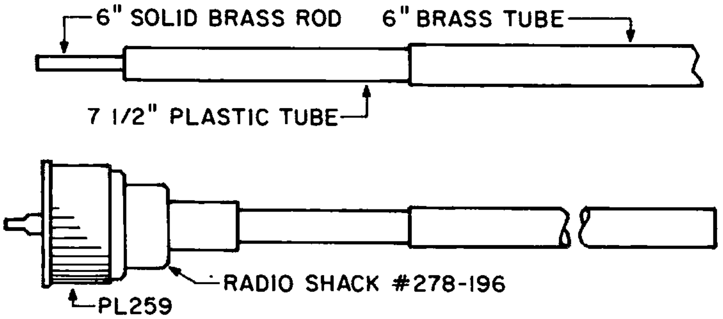


Figure 3. Preparing the gamma match.

will be able to precisely snap the element into two pieces, using the following element lengths: Scribe two arrows at 19-7/8", two at 19-1/4", two at 18-1/4", and two at 17-1/8". These pairs of elements will make up the reflector, the driven element, and the first and second directors, respectively.

The Easton EAGLE 1816™ arrow shafts that I used have conical plastic tips that are used for cementing on the nocks in normal arrow construction. The plastic tip should *not* be used when measuring the element length, but should be left intact in order to seal up the end of the element. When you purchase the arrow shafts from an archery supply store, you will be given inserts that are used for attaching the field points to the arrow shaft. These inserts will be used for attaching the elements together and to the boom. When installing the inserts, apply a small amount of epoxy.

Please note that the boom width is not included as part of the calculation for overall element length. The element diameter will have an effect on element length, and I do not recommend exceeding the element diameters by more than 0.100". Many aluminum arrows are greater in diameter than the 1816 Easton EAGLE. The 1816 is the smallest arrow shaft that will accept the 8-32 threaded insert. Our prototype antennas both used larger diameter arrows. The change to the 1816 was only a factor of cost.

Starting with the 19-7/8" reflector pairs, install one 8-32 threaded rod 1" into one of the element halves. In our construction, we used LOC-TITE™ to permanently affix the 8-32 x 3" rod into the arrow shaft. Install the remaining threaded rods into the other three element halves.

To fabricate the gamma match you will need a PL259 solderless connector, a 6" solid brass rod 0.080" O.D., a brass tube 0.180" I.D. x 0.240" O.D., and a plastic tube 0.175 O.D. x 0.080 I.D. 7-1.2". Solder the 6" brass rod into the center of the PL259, flush with the tip of the connector, just as you would for attaching RG-58 coax. Next, slide the 7-1/2" plastic tubing onto the 6" brass rod and cover the plastic tubing with the 0.180" I.D. x 0.240" O.D. brass tube. This assembly is now your gamma match. To complete the assembly you will need to epoxy the plastic tube into the connector. After tuning the antenna, you may want to tape the brass tube in position, and mark the position of the shorting bar for convenient setup in the future.

To make the shorting bar for the gamma match you will need a small piece of aluminum 1.5" x 0.5" x 0.5" (see Figure 5). Measure and mark a place on the aluminum block 1/4" from one end and 1/4" from the edge of the block. This should place your mark along the center of the width of the block. Measure exactly 1" from the previous mark and again center this mark along the width of the block. Drill a hole 7/32" through at your first mark and drill a through hole 9/32" at the second mark. Standing the block on end, drill a 0.201" hole into the 0.5" x 0.5" block end, keeping the hole centered in relation to the block. Drill into each end of the block until the drill bit is visible through the previously-drilled 7/32" and 9/32" holes. Tap the two end holes for a 1/4"-20 thread. Two 1/4"-20 bolts will be used for setscrews to attach the shorting bar between the gamma match and the driven element.

Assembly

The Arrow Antenna is now ready for assembly. Place the threaded end through the 11/64" hole in the boom and screw on the other half of the element. (See Figure 4 for the correct placement of the elements). Continue down the boom, installing the rest of the elements. Screw the bulkhead connector onto the gamma match, then screw one of the panel nuts flush to the gamma match. Now insert this assembly through the 5/8" hole forward of the driven element, tightening it in place with the bulkhead panel nut. Attach the shorting bar over the end of the driven element that is parallel to the gamma match. Slide the bar along the element until you reach the end of the gamma match, and slide the shorting bar onto the end of the gamma match. Using the 1" x 1/4-20 bolts, fasten the shorting bar so that it is flush with the end of the gamma match. Connect the coax to the other end of the bulkhead connector. Mast-mount your antenna and route your coax so

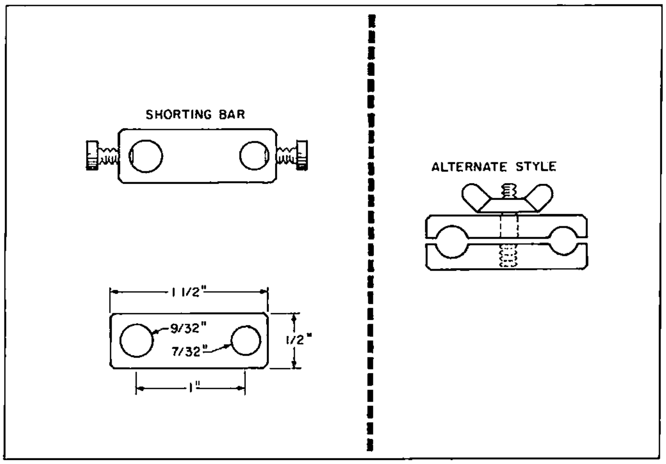


Figure 5. Two alternatives for the gamma match shorting bar.

that it is close to the boom and mast. You are now ready to test and tune your antenna.

Testing and Tuning

The antenna is tuned by sliding the outer brass tube out and moving the shorting bar along the gamma match assembly and test for the best SWR. In our experience, the antenna should be within acceptable limits of < 1.3:1, if the assembly has been constructed carefully. Our antennas have all tuned to an SWR of 1.1:1 at 146.520 MHz.

Disassemble the antenna and screw the element pairs together. Install one of the 1-1/4″ crutch tips onto one end of the boom. Insert the bundle of the four element pairs into the boom. Drop in the gamma match and shorting bar. Install the second crutch tip, and you're ready to go portable.

NOTE: For permanent installation, I recommend that star washers be installed when attaching the elements to the boom. The addition of star washers should keep the elements from vibrating loose. Normal care should be taken to weatherproof your antenna. Seal the coax connection and the end of the gamma match assembly.

We Won a Respectable Second Place

I entered the antenna in the 1991 Dayton Hamvention VHF antenna competition. Al N0IMW and I both wondered how the Arrow Antenna would measure up. We were not disappointed with the results; in the homebrew category, the antenna measured 6.1 dB gain over the reference dipole used for testing.

The winning antenna was 35′ long with 19 elements and 14.3 dB gain over the reference dipole. Al and I will be looking forward to Dayton '92. We will be ready to compete again.

I was fortunate to have John Wood KC0WA as my mentor for antenna construction. Because of John's encouragement and help during our antenna experimentation, the Arrow Antenna evolved to its present form. 73

You may contact Mike Walker KA0VFF at 3816 Ash Avenue, Loveland CO 80538.

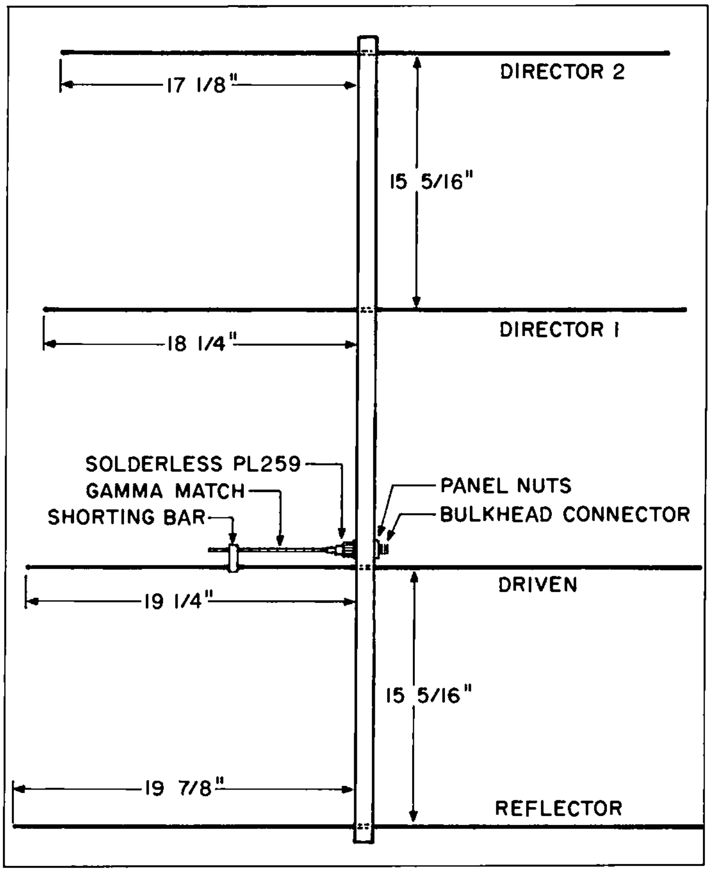


Figure 4. The overall dimensions of the completed Arrow Antenna.

The Arrow Antenna

Specifications	Configuration	Yagi	
	Number of elements	4	
	Matching System	Gamma	
	Boom Diameter	1″ square, aluminum	
	Boom Length	4′Element Material	7075 aluminum
		(Arrow Shafts)	
Gain	Measured (forward)	6.1 dB over reference dipole (estimated over 9 dBi)	
	Measured (front-to-back)	10.1 dB	

Note for direction finding: This makes the signal peak directly off the front and the deepest null directly off the back of the antenna.

Special Features	Portable	All antenna hardware fits inside the boom for storage or transport.
	Assembly time	Less than two minutes
	Weight	24 oz.
	Bandwidth	4 MHz (144–148)
	SWR over band width	<1.5:1
	SWR at 146.52	<1.1:1

Parts List

1	1″ x 1″ x 48″ piece of square aluminum tubing (NOTE: The wall thickness of our square tubing was 0.0625″ allowing us to pack all the antenna hardware inside the boom.)
8	Aluminum arrows >20″ in length, and approximately 9/32″ in diameter
1	2″ PL259 bulkhead connector w/panel nuts
1	Solderless PL259 Radio Shack #278-196
1	Male PL259 90-degree connector (optional), Radio Shack #278-199
1	6″ x 0.080″ diameter brass rod
1	7-1/2″ x 0.080″ I.D. x 0.175″ O.D. plastic tube
1	6″ x 0.180″ x 0.240″ O.D. brass tube
2	1-1/8″ diameter rubber crutch tips
4	#8-32 x 2-1/2″ pieces of threaded rod
2	1/4″-20 x 1″ bolts
1	0.5″ x 0.5″ x 1.5″ aluminum bar

The Arrow Antenna is available ready-made for $65 plus $5 postage and handling. Send a check or money order to Mike Walker KA0VFF at 3816 Ash Avenue, Loveland CO 80538. Telephone: (303) 669–2697.

The "Plumber's Delight" Antenna

A new look for the J-pole!

by Eric R. Johnson KB6EPO

There have been many articles published over the years on J-pole antennas. Each design seems to be somewhat different from the next. I have always been interested in J-poles for their simplicity, their gain, and their ability to work independent of a ground plane. I have constructed nearly every design I have seen, with the exception of the few dual-band versions which have been published. I have always shied away from those because of the relative complexity of the homemade matching capacitors and other matching schemes described. I prefer things to be simple. Yet the dual-band idea was intriguing, and I thought that if two bands were possible, why not three?

I set out on a design (or more properly, tinkering) adventure to build a triband J-pole which met these requirements:

1. It must be built from cheap parts which are easily obtainable in virtually any town.
2. It must not require any special tools or test equipment to build.
3. It must be so simple in design that even the laziest of home-brewers (like me) will not hesitate to build one and get it on the air.

A Quest Fulfilled

It looks like an organ pipe cactus is growing on the roof of my shack, but I don't care because the performance-to-cost ratio is most gratifying. It exhibits a built-in triplexer effect, in that I can do any conceivable combination of simultaneous transmitting and receiving on my three rigs without having any rig interfere with the normal operation of another one. There is no transmitter power bleed-over from one feedline to any of the others.

For example, transmitting 30 watts on 440 MHz will not open the squelch on my 2 meter rig, nor interfere with the simultaneous reception of the local 2 meter repeater. While I have no real scientific means of measuring gain, I can tell you that from my QTH in Baja California, I am able to get into the repeaters on Mt. Palomar Q5 with only 100 mW of transmitter power on all three bands. These repeaters are about 90 miles from my QTH. Using a quarter-wave ground plane antenna and 1 watt transmitted power into the same group of repeaters, I received a Q3 signal report on 2 meters and was unable to access the 1.25 meter and 70cm machines.

Let's Build It

A trip to your local hardware store will provide everything you need for this project. The antenna is built from 1/2" copper water pipe and fittings. You'll need about 8 feet of pipe, so a 10-foot length will do nicely. You'll also need three "T" fittings, three male-to-female 90 degree elbow fittings, and one reducing fitting.

The reducing fitting is the means by which I mounted my antenna. More on that topic later. Right now, let's play plumber! Figure 1 shows the overall view of the complete antenna. The top stub is for the 70cm band, the center one for the 1.25 meter band, and the bottom one for the 2 meter band. The 70cm section should be made first.

Cut the pipe so that when the pieces are assembled, as in Figure 2, the overall dimensions will be true. For the 70cm section only, it will be necessary to cut a small amount off of both the "T" and the male end of the elbow in order to obtain the small 0.375" gap required.

Lay the assembly down on a flat surface and align the pieces, then dimple at the places marked "X" in Figure 2. I used a 16 penny nail and a large rock for this task. You may want to use a small ball peen hammer if you have one handy. Now use a propane torch to solder everything together. Be careful not to use too much solder or else you'll have the same problem I did the first time. The excess solder will get into the as-yet-unused end of the "T," and you'll have a devil of a time getting it cleaned out!

In the same manner cut, fit, dimple and solder the pipe for the 1.25 meter stub. This stub will be 180 degrees away from the 70cm stub. Now do the 2 meter section. This stub will be 180 degrees away from the 1.25 meter stub, and directly below the 70cm stub. Finally, take any pipe you have left and solder it into the unused end of the 2 meter "T." This is where you will attach the antenna to its mount.

Putting It in the Sky

I soldered a reducing fitting to the bottom of my antenna to provide a means of mounting it. The copper fitting has a 3/4" female pipe thread on one end, and a 1/2" female slip-fit on the other end. This fitting is depicted in Figure 1. Since 3/4" galvanized thin-walled electrical conduit is cheaper than copper, I used a 10-foot section of that for a mounting pole.

A male-threaded fitting is available for the conduit, which allows it to screw into the bottom of my copper antenna. The conduit is clamped to the side of my shack near the roof peak. The whole conduit/copper antenna assembly stands by itself unguyed, and is quite sturdy. You may think of a different way to mount the antenna at your location, and so may not need the reducing fitting. Automotive hose clamps, to hold the antenna to the top of an existing mast, is one possibility that comes to mind.

There is no need for a ground plane or even a grounding wire. The antenna will work the same with or without them. From a safety standpoint, however, it is a good idea to ground the antenna.

To ensure a wobble-free 2 meter stub, I used a scrap of 1/4" thick Plexiglas™ roughly 2" square, close to the top of the stub, as a brace. I drilled holes through the Plexiglas and pipe, and used two 6-32 screws on the stub and two more on the central mast to hold the brace in place. This probably wasn't necessary, but I had the material lying around, so what the heck! The other two stubs are most definitely sturdy enough on their own.

Connecting The Feedlines

The antenna has three feedlines, one for each band. The feedlines should be a small diameter 50 ohm coaxial cable, such as RG-58, RG-223, or mini RG-8. I used RG-223, which is a double-shielded cable. Connect the feedlines to their respective elements as shown in Figure 2. Note that all shields connect to the mast, and all center conductors connect to the stubs. The distance above the bottom of the "J" to connect the coax is given by dimension "F" in the table.

Continued on page 50

	2m	1.25m	70cm
R (in) = 8370/F (MHz)	57.375	37.375	18.875
S (in) = 2787/F (MHz)	19.125	12.500	6.250
G (in) = 165/F (MHz)	1.250	.750	.375
F (in) = 345/F (MHz)	2.500	1.500	.750

R = radiator; S = stub; G = gap; F = feedpoint.

The Flower Pot Special

Plant your antenna!

by David Cassidy N1GPH

The Hidden Antenna Dilemma

People who live in apartments or condos are constantly searching for new ways to get out an HF signal. There are several ways to solve this problem, if the landlord is willing to let you string wires outside the building, but more often than not the problem is simply that no antennas are allowed . . . period.

The typical suggestions for "invisible" antennas are usually not very invisible, especially over a period of time. An HF vertical disguised as a flagpole is pretty good, if you own the space (including the space for underground radials) and are allowed to erect the flagpole. Magnet wire antennas work fairly well, but it's only a matter of time before the feedline is discovered—and then not only do you have to take the antenna down but you risk the wrath of your landlord. Indoor antennas are truly invisible to the outside world, but you're bathing yourself (and your neighbors) in potentially harmful RF radiation, not to mention the TVI problems incurred. Roll-up antennas are OK, but very few locations can accommodate them, and it's a nuisance to have to erect your antenna every time you want to check out band activity.

What we really need is a truly invisible antenna, one that can stand up to long-term scrutiny and still allow for easy operation with a decent signal.

Flower Power

With the abundance of high-quality mobile antennas available, all that is needed for a decent HF signal is a mounting arrangement. . .and a clever disguise. Enter the Flower Pot Special—the clandestine antenna mount that even the KGB would be proud of!

The solution proposed here will be of special interest to hams who have the most difficulty in getting on HF—city dwellers. Although this arrangement can be set up in the corner of a room, if you have access to a balcony (especially a balcony on a high floor), you'll be amazed at the results this invisible antenna can produce. If you're stuck on the ground floor don't worry. I've seen ground-mounted flower pots work Europe consistently when the band is open.

Take a look at the photos; the flower pot antenna mount is almost self-explanatory. The photo shows a Flower Pot Special that was put together by Don Arnold WD4FSY of Outbacker Antenna Sales. Don is the one who

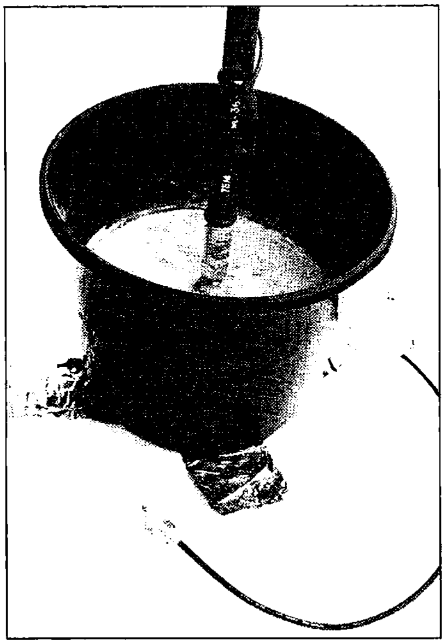


Photo A. The Flower Pot Special.

actually came up with this unique arrangement, and he uses the Flower Pot Special to demonstrate the Outbacker all-band HF antennas at hamfests. The Outbacker is especially suited for operating from an apartment or condo because it offers multiband capabilities from a single element—all you have to do to change bands is plug the wire that wraps the antenna into the appropriate plug on the antenna—but as long as you match the mount to the type of antenna you're using, the Flower Pot Special will work with any type of mobile antenna.

Construction

To build the Flower Pot Special you will need:

•1 flower pot. The one in the photo is 9″ tall and 10″ across at the top.

•1 metal junction box. These are used to mount AC outlets in your walls. They are usually covered with knock-out plugs for running wire through. If you can't find one that has a hole in the center, you'll have to drill a hole to accommodate your antenna mount.

•4′ of 3″ copper foil. If you can't find this at your local hardware store, you can get it at Ham Radio Outlet. The stock number is GW0065, and you can get 50 feet for less than 30 bucks. Don't worry, you won't have too much. You'll use most of the roll for your ground plane.

•1 roof-mount assembly. This is the kind of mount you install by drilling a hole in the roof of your car. Mine has a standard 3/8 x 24 thread mount.

•3′ RG-58 coax, wired with appropriate connectors. One end of this will be attached directly to your mount, just as if you were installing it on your car.

•1 bag (8–10 lbs.) of anchor cement. You can get this at a hardware store or home center. It sets up in about 10 minutes, and is less brittle than normal cement.

The first thing you want to do is cut four slits in the bottom of your pot. The slits should be long enough to allow the copper foil to pass through (about 4″), and far enough from the sides so you can totally hide the ground plane (if necessary). One to two inches should be sufficient.

Next, prepare your mount. Punch out or drill a hole in the center of your junction box. Cut your copper foil into two 2′ sections, cross them over the hole in your junction box, poke a hole in the copper foil and fasten the antenna mount to the junction box according to the manufacturer's instructions (with the crossed foil/junction box taking the place of the car roof).

Snake one end of your coax through one of the slits in your flower pot. (If ultimate disguisability is not a factor, you can drill a hole in the side of the pot at the bottom to let the coax through. Passing the coax through one of the bottom slits will allow you to hide the feedline under the carpet, behind other potted plants, etc.) Attach the coax to your mount according to the manufacturer's instructions (some mounts are hard-wired, others require a PL-259 or other connector).

Place the junction box/antenna mount inside the pot, and snake the copper foil out through the four slits cut in the bottom. Remember, the mount will be elevated 2″–3″ from the bottom of the pot, so don't pull the foil too tight. Once you're happy with the placement, tape up the holes with duct tape so the cement won't pour out.

Attach your antenna to the mount, then pour in your pre-mixed cement. Pull the mount up as you pour so that you don't cover it up with cement. Keep pouring until the pot is about half full of cement and make sure the mount is sufficiently submerged. Shake the

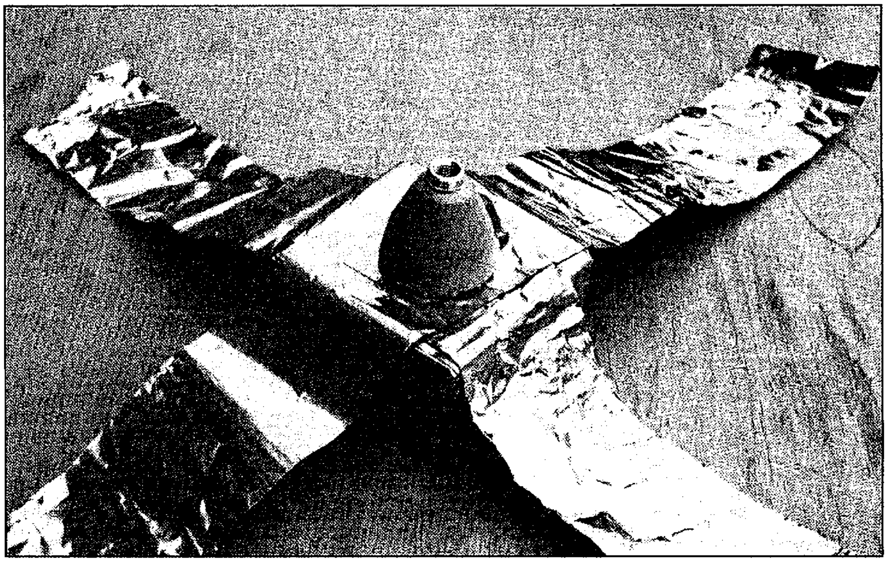


Photo B. Junction box, copper foil and antenna mount assembled and ready for "planting."

pot back and forth to make sure there are no air pockets, then hold the antenna vertical for five to 10 minutes until the anchor cement firms up.

Your Flower Pot Special is now complete. As soon as the cement thoroughly dries you are ready to hide your handiwork.

Camouflage

Once the cement is dry, you can attach your antenna to the mount and conceal it with plastic greenery. If you check out florists, home centers and craft shops, you will find a vast array of amazingly real-looking plants. The only caveat here is: Make sure that the fake plants you use to disguise your antenna are not built around a wire core. This will play havoc with your antenna's SWR and signal. You should be sure to only use non-conductive materials to disguise your antenna. While you're picking up your disguise plants, be sure to get a bag of spaghum moss or wood chips to cover and conceal the cement. With enough greenery, even your ham friends won't recognize your home decoration as an antenna.

Grounding

The reason you went through all the trouble to install that copper foil is that this antenna absolutely must have a ground plane. If you want to prove this for yourself, hold a fluorescent tube near the antenna while transmitting a carrier. With the pot resting on a ground plane, the tube will light brightly. Lift the flower pot off of the ground plane and the light will immediately go out. Remember, the antenna you're installing is designed to use a car body as a ground, so you must provide an equivalent or you won't get out any kind of a signal.

There are many possible ways to provide a ground plane for your flower pot, all of them dependent on where the antenna will be placed. If you are going to place the disguised antenna in a corner of an apartment balcony, look for a metal railing to attach to the copper ground strips. If nothing else is available, you could run a length of the copper tape around the balcony. If you are going to leave the flower pot indoors (grouped with other plants, you'll soon have to remind yourself that it's an antenna), you could run copper foil and transmission line under the carpet or behind the baseboard. With a little time and imagination, the flower pot can be installed so that it is totally undetectable.

You need a total of five to six square feet of copper foil to provide an adequate substitute for a car body. Really put some thought into how you can provide a ground plane, and it will pay off with a better signal.

With Power Comes Responsibility

It is important for those hams who are forced to operate from apartments or condos to remember that just because they have come up with an ingenious way to conceal their antenna, it is all for naught if every telephone, stereo and television in the building makes weird noises each time you transmit. You could probably hide the fact that it is you who is causing all the interference, but sooner or later you will be discovered as the culprit. Not only will that make you very few friends, but it will give all of your neighbors a bad impression of amateur radio forever.

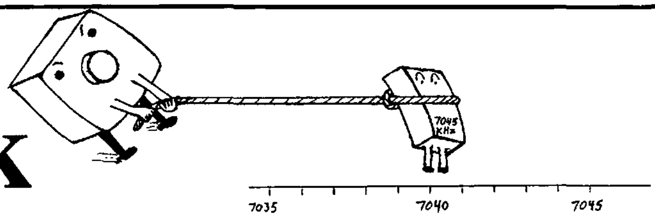
I'm not suggesting that you advertise that you are operating a ham station from the 14th floor, but for the sake of hams everywhere, make sure that you are acting as a responsible amateur as well as a good neighbor.

I'd appreciate hearing from anyone who decides to build a Flower Pot Special. I'm sure many of you will see other ways of putting together a similar antenna mount. I'd like to hear about your results, and any ways to improve the basic construction methods given here.

Good luck, and happy planting! 73

David Cassidy N1GPH is the associate publisher of 73 Amateur Radio Today. *He can be reached at the offices of* 73, *Forest Road, Hancock, NH. 03449-0278.*

The Rock Bender QRP Transmitter



Win QSOs and influence crystals.

by Randy Henderson WI5W

If you want a simple way to generate stable signals, a crystal oscillator will do nicely. The only problem is, you have one available frequency per crystal. This transmitter will "bend" the frequency of your "rock" (quartz crystal) to create a tunable oscillator.

The "Rock Bender" features two stages, an oscillator and a power amplifier. The tuning range varies with individual crystals. Various 7 MHz crystals will allow 6 to 20 kHz of tuning range. The version shown here has an output power of 3 watts into a 50 ohm load. A slight modification allows output levels of 10 watts or greater. It is extremely tolerant of mismatched loads.

Construction

The circuit board is double-sided. One side is a conventional etched pattern, shown in Figure 1. The other side is a solid copper ground plane, except where holes are drilled for component leads. All ground connections are soldered on this side. If you are making your board from the pattern, many methods can be used to form the resist paths. These include: tape, resist pen, and photo resist. See the construction chapter in recent versions of the *ARRL Handbook* to learn more about such techniques. Enamel spray paint is an easy way to cover the ground plane.

All components mount on the ground plane side (see Photo B). Only grounded leads are soldered to the ground plane. All other leads pass through the ground plane to the etched side of the board. They must not make contact with the ground plane. To prevent accidental contact, countersink the ground plane at the holes indicated as ungrounded in Figure 2. Use a substantially larger bit for countersinking than the component lead hole (1/4" to 1/2"). Light pressure on the drill will clear away copper from the periphery of the holes (see Photo C).

Place the components as shown in Figure 2. Q2, the IRF511 output transistor, should be mounted close to the board with short leads, as well as C8. I leave conductive foam, aluminum foil, or wire, on the leads of Q2 until all of the board components are soldered in place. Shorting the leads together protects against damage from static electric charges and soldering iron leakage. Don't forget to remove the short before applying power. All other components should have reasonably short leads. Q2, L4 and the crystal socket will need larger holes and countersunk areas.

The variable capacitor C2 does not solder directly to the board. Use a short, stiff wire jumper to connect the stator plates (see Photo D). Most defunct AM broadcast receivers have small polyethylene film variable capacitors suitable for C2. To my knowledge, all use metric-sized screws. Many have internally threaded shaft ends. I find that some rubber cabinet feet make suitable knobs when the original is not available. Use care when mounting variable capacitors. Do not run the screws in far enough to damage the plates. Use washers, spacers or shorter screws. If necessary, shorten the screw and repair the threaded end.

L4 is made of 22-18 AWG solid copper wire. Enamel insulation is preferable, but not essential. Wind four turns over a 3/4-inch-long PVC pipe section. The size of pipe used for the coil form is known as "1/2-inch." This is a convention used by the plumbing industry and is not the actual outside diameter. The outside diameter is approximately 0.84 inches. The length of the winding is about 1/2 inch. Do not secure or cement the turns in place at this stage of construction.

The mounting holes for the circuit board are not shown in the layout. Place mounting holes as you wish, but do not allow supports to short or ground conductors on the etched side of the board.

Although Figure 3 doesn't show a fuse, some type of

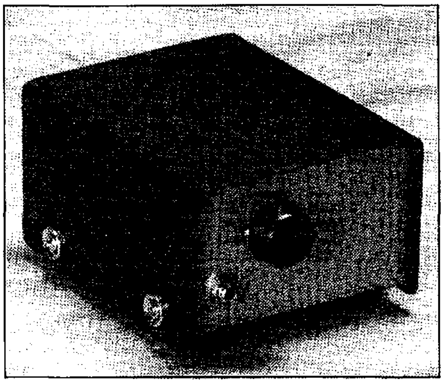


Photo A. This well-dressed Rock Bender sports a black-and-gray cabinet from Mouser Electronics (part number 4OUB101). The key jack is near the lower left corner of the front panel. The tuning knob is a black rubber cabinet foot.

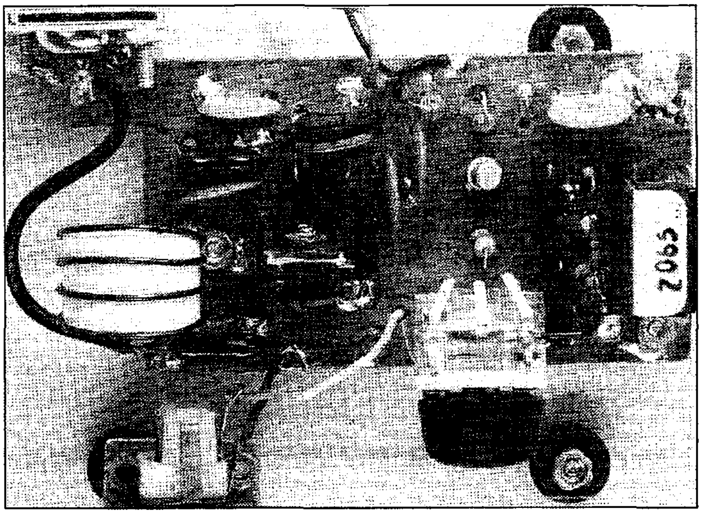


Photo B. Rock Bender au naturel. The board is mounted on a clear piece of Plexiglas™. The PL-259 antenna connector is wired to the board via RG-158 miniature coax. A key jack is at lower left.

Photo C. Countersunk holes on the ground plane provide safe passage for component leads without disturbing printed circuit paths on the other side.

current limiting device should be used to protect the transmitter. If your power source does not include a fuse, circuit breaker, or active current limiter, wire one into the positive supply line. A 3/4 or 1-A rating is suitable for the 3 watt output level.

The jumper shown in Figure 2 must be connected for oscillator keying. It does not connect to ground.

Connectors are needed for the antenna, the key and the power source. If you're an inexperienced builder, bring these accessories to the parts store to simplify finding the matching connector.

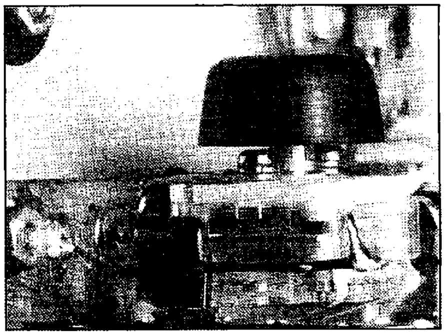


Photo D. A mounting bracket fabricated from a wire paper clip supports C2. Ground connections for C1 and C5 are visible. Hand capacity affects the frequency slightly when C2 is mounted this way.

Circuit Description

Figure 3 shows Q1 in a modified Colpitts oscillator configuration driving Q2. The output of Q2 is filtered and undergoes an impedance transformation before reaching the antenna terminal. This dual function is performed by a pi network consisting of C11, C12 and L4.

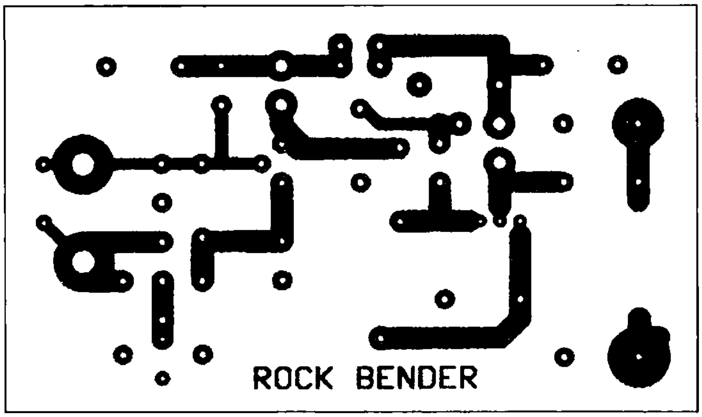


Figure 1. The isolated pads with no traces connected show the location of ground connections. These can be drilled or simply used as a visual reminder for soldering to the ground plane.

Keying is accomplished by providing a ground path for the emitter of Q1 and the source of Q2. No keying transistor is used.

You may want to experiment with operating the oscillator continuously. This often provides improved keying characteristics when you're trying to stretch the tuning range. Use a small heat sink on Q1. The oscillator keys satisfactorily with moderate tuning limits. Those of you "bent" on extending the limits may find help in reducing chirp by eliminating the jumper. Install a switch between the free end of R3 and ground.

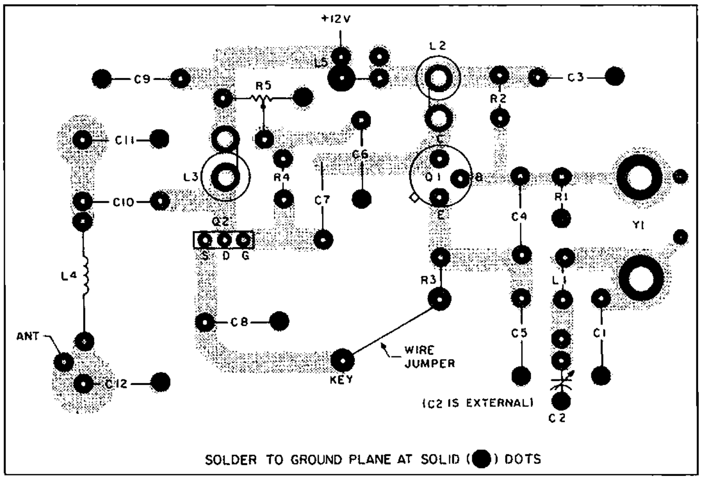


Figure 2. This is a view of the component side. It is also the side of the solid copper ground plane. The etched pattern is underneath, invisible from this side. Open circles mark component leads that pass through the ground plane to the etched side of the board. Countersink the ground plane at those locations.

What determines the tuning range for a particular crystal? LI has, by far, the largest effect. The optimum value for LI depends greatly on the type of crystal used. With most FT-243 crystals, 18 to 20 µH works well. HC-6 and HC-18 types seem to need more inductance. I used a total of 38 µH with one HC-6 crystal to obtain 10 kHz of tuning range. Some builders report 20 kHz of shift using old military/government surplus crystals with very large holders.

The value of L1 affects tuning in a very non-linear manner. Substituting a 15 µH inductor in place of an 18 µH inductor may reduce the available tuning range by 80 percent. If LI is too large, the oscillator will usually malfunction in one of two ways. It may lose most or all of the tuning range. In this case, oscillation may take place at a frequency very close to the value marked on the crystal holder. Oscillation can also take place at frequencies several hundred kHz away from the marked frequency. You certainly don't want to operate the trans-

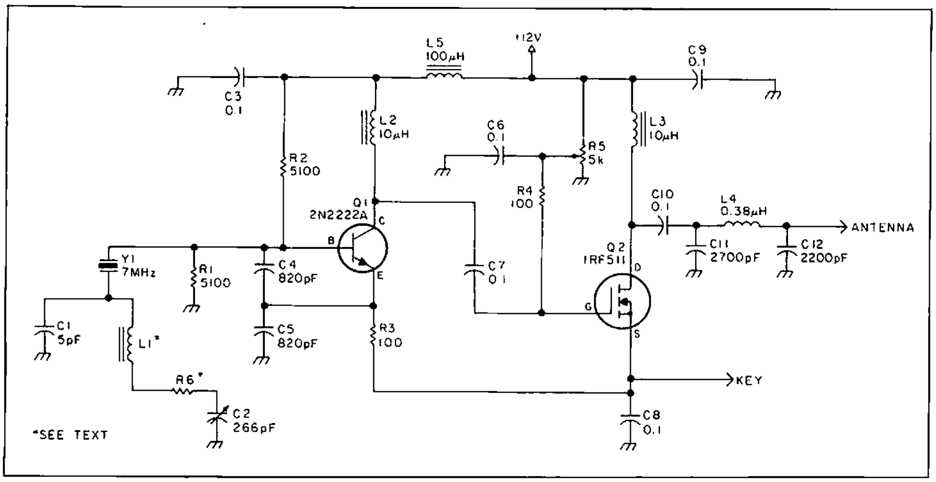


Figure 3. A 40 meter version of the Rock Bender.

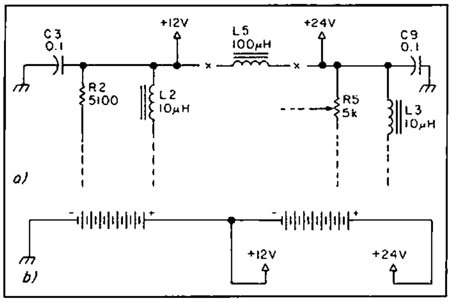


Figure 4. a) Use dissimilar power connectors for the 24 volt and 12 volt bus or one 3-pin connector keyed to plug in only one way. This will preclude accidentally swapping power sources. b) Two 12 volt batteries in series. Remember to use a fuse on both positive leads to the transmitter. About 200 mA for the 12 volt tap and 750 mA for the 24 volt lead.

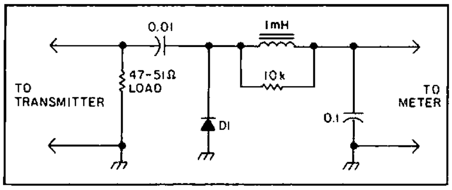


Figure 5. This circuit samples RF voltage across the load. A DC voltage appears at the meter terminals. The RMS value is approximately 0.707 x peak. If R is the load resistance and E is the voltage indicated by the DC voltmeter, then power = (0.707E²)/R. D1 is an RF or high-speed switching type of diode. A 1N34A germanium or 1N914 silicon will work. If you first subtract the characteristic voltage drop from E, the calculation is more accurate. Use 0.4 volts for germanium or hot carrier diodes and 0.7 volts for silicone. The 10k ohm resistor loads the RF choke to eliminate erroneous readings caused by parallel resonance effects.

mitter out of the band.

A low-Q inductor seems to work best at L1. High-Q toroidal inductors are often unsatisfactory. Decreasing the Q and the crystal current even more by using R6 often improves keying characteristics. The largest value I've used is 47 ohms for FT-243 crystals. The lowest value is zero ohms. Small, low-Q, low current, high DC resistance, molded chokes are a good choice for L1. The best configuration for L1 is often two or three molded chokes in series. For instance, you might use two chokes of 9.1 µH each, for a total of 18.2 µH.

C2 is the tuning control for actual on-the-air operation. Using a larger value variable capacitor may provide increased tuning range in some transmitters.

Component values for the rest of the transmitter are not so dependent on crystal Y1. Potentiometer R5 sets the gate bias voltage for output transistor Q2. R4 acts as a "swamping" resistor. In other words, it loads the gate circuit of Q2 to stabilize the output stage and prevent parasitic oscillations. It also helps establish a stable load for the oscillator.

If you need a bit more output power, here's how. The output transistor, Q2, works very well with a 24 volt DC supply. At this voltage, Q2 needs a larger heat sink with a few square inches of surface area. An aluminum chassis can be used by mounting Q2 upside down (on the etched side of the board) and thermally coupling to Q2 with a mica insulating washer covered with heat-sink compound. The gate bias voltage will need to be lower (adjust R5). At 7 MHz, 10 watts of output power is available.

Wait! Don't rush to the nearest 24 volt supply. The transmitter absolutely will not tolerate a 24 volt DC supply to Q1. The drive level (RF voltage) is so high that it punctures the gate insulation, destroying Q2 instantly. L5 is a decoupling choke for the oscillator supply. By removing L5, you can operate the oscillator at 12 to 14 volts and supply 24 volts to the IRF511 amplifier (see Figure 4a).

Crystal Y1 operates in the fundamental mode in this circuit. Overtone cut crystals also operate in the fundamental mode. At present, there are sources of very inexpensive fundamental mode 7 MHz crystals. For this reason, development of the transmitter was concentrated on the 40 meter band. This transmitter also works on 14 MHz by changing a few component values. Reduce C4 and C5 by half. Change C11 and C12 to 910 pF. Change L4 to 0.24 µH. This is for a supply voltage of 13.5, 2 watts output and a network Q of 4 (including transistor output capacitance). You can achieve initial operation (and very little tuning range) by using a jumper in

place of LI. With the optimum value for L1, the tuning range will be much greater than the 40 meter version. Output power is less. Operation on other bands should be possible. Certainly, 30 meters is a prime candidate.

Initial Checkout

Before applying power to the transmitter, you should make a thorough visual inspection. Check for solder bridges, poor solder connections, melted wire insulation and component leads touching other conductors. Double-check all connections to make sure they agree with the schematic diagram.

To adjust the transmitter, you will need a dummy antenna and some way to measure output power. A 47 ohm, 2 watt, carbon-composition resistor can be used in lieu of a standard dummy load for the 3 watt version. Just check it occasionally to make sure it's not getting too hot. If you don't have a wattmeter for this power level, see Figure 5.

The wiper of R5 should be rotated all the way toward the grounded leg. You can check this with an ohmmeter. Next, plug in a key. Make sure it can handle the current if it's an electronic keyer. Keying current is a hefty 500 to 600 mA at 13.5 volts.

The last step before key-down testing is to connect a 12 to 14 volt DC power source. With C2 at midrange, key the transmitter. The grounded wiper of R5 sets the gate bias voltage to zero and the output level will be very low. It should be less than 1/2 watt, possibly less than 100 milliwatts, depending on the supply voltage. Find the transmitter signal with your receiver. If you can't find the signal, LI may be too large. C2 should shift the frequency over a range of at least 5 or 6 kHz. If not, LI is too small. A very few FT-243- style crystals may refuse to oscillate if their activity is on the sluggish side. At the risk of sounding like an advocate of crystal abuse, I have found that a sharp blow from a pencil or similar object brings them to life. Once so "enlightened," they work perfectly until disturbed. I suppose the spring-loaded nature of the holder may be responsible for this behavior.

If everything is okay, slowly rotate R5. Stop rotation when the output level reaches about 2.5 watts. The only other adjustment needed is to tune L4. Do this by spreading or compressing the winding. The output should peak at some point. Adjust R5 for an output level of 3 watts. Re-check L4 and cement the winding in a few places.

Refinements and Options

If you have never used a separate transmitter and receiver before, you have some decisions to make. If you hook this transmitter to your antenna, how do you get incoming signals to the receiver? One way is to use a separate antenna. Most modern HF receivers (and transceivers) receive reasonably well with a few feet of wire strung up around the shack. Try to keep the receiving antenna away from the transmitter feedline and antenna. To use a single antenna with a manual TR (transmit/receive) switch, see Figure 6. A W7EL-style electronic antenna switch is shown in Figure 7. (See: R. Lewallen, "The Optimized QRP Transceiver," *QST*, August 1980, pp. 14–19.) Automatic antenna switching is performed by a relay in Figure 8.

Operation

The frequency marked on an FT-243 holder is the approximate upper tuning limit. The tuning range is downward from that point. Keep this in mind when ordering crystals. Smaller crystals (HC-6, HC-18) may tune up to 1 kHz higher than the marked frequency.

It's nice to move around the band and answer other stations when using low power instead of being "rock-bound." Once you find their signal, how do you get your transmitter there? Calibrating the dial helps, but only for approximate tuning. Unfortunately, the calibration becomes invalid if you plug in a different crystal. Simply press the key and turn the tuning knob, but not on the air. Use a dummy antenna and match the beat note by listening to your receiver. When the other station finishes calling CQ, switch to the antenna and reply.

I have attempted to make this transmitter as useful as possible, considering the limited number of parts and the circuit simplicity. I would like to thank John Carter W5LGO for providing a great deal of assistance in the circuit design, board layout, board fabrication, testing and parts procurement. Circuit board kits and bare boards are available from John at 1620 S.E. 24, Norman OK 73071. Bare boards are $7.50. Kits with a crystal are $39. Thanks also goes to intrepid Oklahoma area amateurs who served as guinea pigs by providing feedback about construction and operation.

The pride and satisfaction of telling another operator, "Rig is home-brew," has to be experienced to be believed. Building your own equipment can open up a fascinating new dimension of amateur radio. Try it out and see! 73

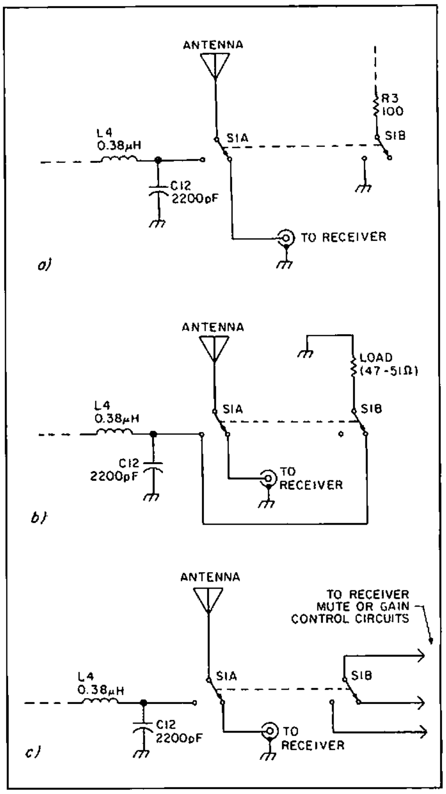


Figure 6. A miniature double-pole double-throw toggle switch can make life with a Rock Bender more pleasant. At A, antenna switching is accomplished by S1A. Amplifier keying is used. The oscillator is turned on by S1B in the transmit position. A keyed oscillator is used at B and a dummy load is automatically switched in during receive. This allows you to press the key and spot the transmitter without putting a signal on the air. C shows how S1B could also be used to reduce receiver gain. You can have a more pleasant sounding and accurate representation of the transmitted signal if receiver overload is minimized in this manner. Where and how you connect S1B will depend on the receiver being used.

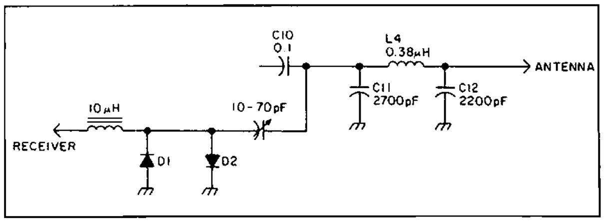


Figure 7. A simple electronic TR switch for 7 MHz. The variable capacitor is adjusted for maximum receiver sensitivity. This will be around 50 pF with a non-reactive receiver input. D1 and D2 are high-speed silicon diodes such as 1N914 types. Receiver overload is severe (not damaging). Some form of automatic or manual gain control may make the keying sound better in your station receiver.

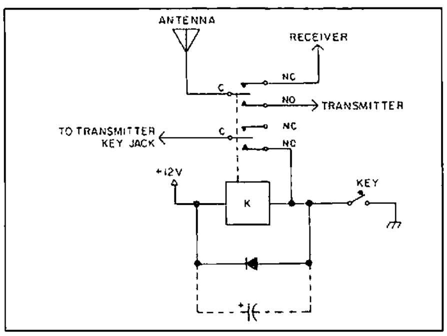


Figure 8. When you key the relay, it keys the transmitter. An optional electrolytic capacitor will provide semi break-in keying. Try 100 to 500 µF. Transmitter output occurs after relay contact is made and ceases before contact is broken. Another set of contacts or another relay can be used for gain reduction or muting at the receiver. K is a 12-volt relay to be operated from the 12-volt transmitter supply.

Contact Randy Henderson WI5W at 10809 N.E. 17th Street, Oklahoma City OK 73141.

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CIRCLE 121 ON READER SERVICE CARD

73 Review

by David Cassidy N1GPH

Heil HM-10 Dual and BM-10 Boomset Microphones

Heil Sound
2 Heil Drive
Marissa IL 62257
Telephone: (618) 295-3000
FAX: (618) 295-2835
Price Class: HM-10 Dual $130; BM-10 Boomset $85, wired.

Anyone who is even mildly interested in home audio knows that the quickest and easiest way of altering the sound of your stereo is to change the speakers. In amateur radio, the quickest and easiest way to alter the quality of your transmitted phone signal is to use a different microphone.

While the stock mikes supplied with modern transceivers are adequate for operating, they are certainly the "weak link in the chain" of most amateur stations. Take away any remote tuning buttons and what do you have? Essentially, a plastic case, a mike element and a momentary contact switch. That's about $5 worth of parts you're using to generate an audio signal in a radio worth thousands.

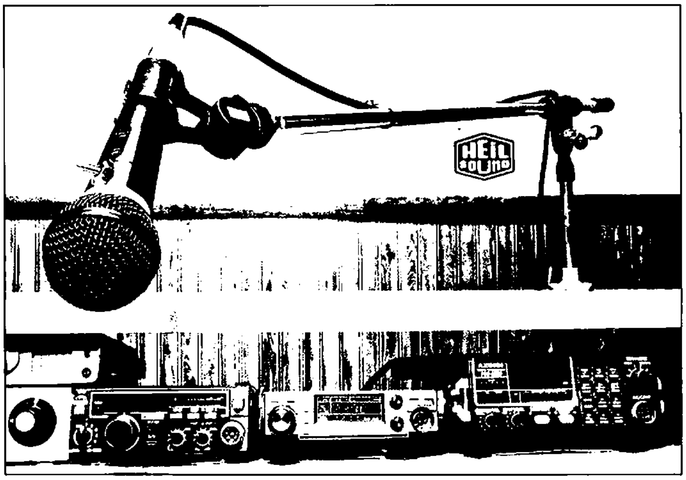

Photo A. The Heil HM-10.

Heil Sound is one of the major manufacturers of after-market microphones and accessories for the amateur radio market. Recently, I got the chance to use several of their products.

HM-10 Dual

The Heil HM-10 Dual microphone is really two mikes in one. Housed in an attractive black microphone casing that looks like the ball mikes used by performers are both an HC-4 and HC-5 mike element. Switching between the two elements is accomplished by a mini-toggle switch mounted on the mike housing (a single element HM-10, with either of the two elements installed, is also available).

When you purchase an HM-10, you must specify either a Kenwood, ICOM, Yaesu, Collins or Ten-Tec cable. The cables are high quality MIDI data transmission cables and color-coded for easy identification. You can purchase the cables separately, so the same mike is easily transferable to any modern HF transceiver by simply plugging in a different cable. The cables come wired with a 1/4" phone jack in the PTT line, so you can wire up any kind of PTT switch you choose. Heil also sells a simple, pre-wired PTT switch and a high-quality foot switch, if you'd rather not do it yourself. There is also a slide switch on the microphone body that is wired for push-to-talk operation, and the mike elements are wired straight through for VOX operation without any switching required.

The heart of the microphone, and what sets it apart from your basic stock mike, is the HC-5 and HC-4 elements. The HC-5 is Heil's full-range, standard element. The element's frequency response rolls off below 300 Hz and has a 6 dB peak at 2100 Hz. This provides a nicely balanced, but slightly "punchy" sound, good for normal rag-chewing and other run-of-the-mill QSOs. Heil designed the HC-4 element with DX and contest operators in mind. The low-end roll off is 100 Hz higher at 400 Hz, and there is a 10 dB peak at 2100 Hz. The intention here is to give your voice a crisp high end, allowing it to punch through a pile-up or other interference.

The Coincidental Field Test

After hooking up the HM-10 Dual to my transceiver, I started tuning around 17 meters, looking for an informal opinion of the mike's performance. I had set up some scheds for further testing, but I was anxious to try out the new mike. I came across a couple of guys who were obviously talking about audio quality, so I started to monitor the QSO. After a few minutes of listening, it was obvious that one of the stations had just purchased the HM-10 with the HC-5 element, and was looking for observations on his audio. When he mentioned that he was using the same HF rig as me, I knew that I had to talk to this guy!

We chatted for almost an hour, switching between different mikes and different elements and comparing the results. We both came to the conclusion that the HM-10 and HC-5 combination provided a nice, pleasing audio, with just enough high-end punch to break through mild QRM. In comparison, the stock mikes sounded OK (surprisingly), but everyone who broke into the QSO affirmed that the Heil microphone provided a stronger, more pleasing audio, without the "muddiness" of the stock mikes.

Later that evening, I maintained a schedule with three friends on 80 meters. We spent most of the evening switching mikes, recording and playing back transmissions. The same results were obtained and the same opinions expressed by all: The HM-10 with the HC-5 element beat the stock mike hands-down for clear sound. We all agreed that the H-4 element had a nice, high-end punch, but would not be the element to use for normal rag-chewing. The HC-4 helped cut through the nighttime QRN better than the HC-5, but for normal conditions, the audio quality of the HC-4 is a bit too high-end for my taste. Of course, that's exactly what you want when trying to break into a DX pile-up.

BM-10 Boomset

The BM-10 Boomset has the same mike elements (either the HC-4 or HC-5, but not both) as the HM-10. In this case, the element is attached to a lightweight headset. Like the HM-10, you must order the correct version for the brand of HF gear you plan to use. You can also order a single or double earphone model, depending on your preference and intended use (I used the double earphone model). The microphone wiring arrangement is the same as for the H-10, with the 1/4 phone jack wired for PTT operation.

Since I do a lot of late-night operating, I often use headphones. The quality of the headphones on the BM-10 is excellent—as good as any I've ever used. The earphones cover your entire ear with a flat earmuff (as opposed to an earcup). I like this arrangement

Photo B. Heil's BM-10 boomset.

best, because it allows you to slightly hear outside noise (if you've ever had someone sneak up behind you while you were wearing full-cup headphones you'll know what I mean). The best thing about these headphones (other than the superb audio quality) is their light weight. You can wear them all day without any discomfort (very important if you're a contest operator).

My only criticism of the BM-10 is in the cord arrangement. The headphone and mike cords are totally separate. The headphones have a curly cord (with a standard 1/4 plug), while the mike/boom element has a thin shielded cable. This does allow you to remove the entire boom and use the headphones separately (which, I have to admit, I've done on several occasions), but I would much rather have the mike and headphone cords be a single unit, separating into two cords with two separate plugs a couple of inches from the end. This is a purely subjective comment, since many people would probably find the removable boom a greater asset, but I found the two cords to be a minor nuisance.

On the plus side, I have to mention that Heil has gone to great lengths to make the BM-10 as modular and repairable as possible. The mike element is accessible by unscrewing the cover (Heil mike elements are available separately, so you can replace them easily). The individual earphones can be removed and/or replaced. All wiring is easily replaceable. This is the kind of touch that shows this company is run by hams (which it is).

Accessories, Accessories, Accessories

Heil Sound sells a complete line of accessories for your microphone. In addition to the extra cables, PTT switches and elements already mentioned, you'll want to check out their desk stand or boom stand for the HM-10.

I've always liked the quality of the products I've used from this American company. The HM-10 and BM-10 are fine additions to their line of audio products. 73

Monoband Yagi for 20 Meters

More dBs for the buck.

by Kenneth C. Kemski AB4GX

Like many amateurs, I live in a residential neighborhood where local sentiments do not favor large antenna arrays. Among my favorite operations, however, is hunting DX on 20 meters. This requires attempting to be heard through the pile-ups that develop around almost any semi-rare station that fires up its rig.

There would appear to be three distinct means of achieving the end of "pile-up crashing": blind luck; shouting your call hundreds of times, despite who is talking or listening (much to the consternation of everyone involved); or having an effective signal that allows you to "get in-and-out" within a few calls.

The chain between your microphone and the desired DX station's ears may include many links, and among the most important (after professional protocol) is the antenna. It is difficult to construct an antenna that affords good gain, directional performance, and usable bandwidth in a small package that won't antagonize the neighbors!

My results with semi-inconspicuous verticals, inverted vees and slopers were somewhat discouraging. It appears that one can develop an S-5 to S-6 signal anywhere in the world where propagation exists, and enjoy many a fine QSO. Unfortunately, pile-ups of any size became primarily a means of killing time until the DX station went QRT for the day.

I finally decided to attempt to design a reduced size monoband yagi that would give me a "fighting chance" under adverse conditions (. . . most DX contacts).

The criteria were to obtain: the smallest size possible, 10 dBi forward gain, usable front-to-back and front-to-side ratios, and the ability to withstand Florida's high winds. The result is the antenna described here.

I began to design by purchasing an antenna analysis program, based on the successful Minninec format. It is written and distributed by W7EL, and called "ELNEC." This PC-based program is an absolutely fine undertaking, and is worth many times the asking price. (See the ELNEC review in the January 1991 issue of *73 Amateur Radio Today*.) A detailed description of this program would require an article in its own right. Suffice it to say that I fed my ideas for this antenna into ELNEC over a two-month period, scrutinized the results, and then assembled and tested the final design. I achieved almost total agreement between ELNEC's analyses and real-world performance; for example, the calculated element lengths were within 3/8″ of final tuning!

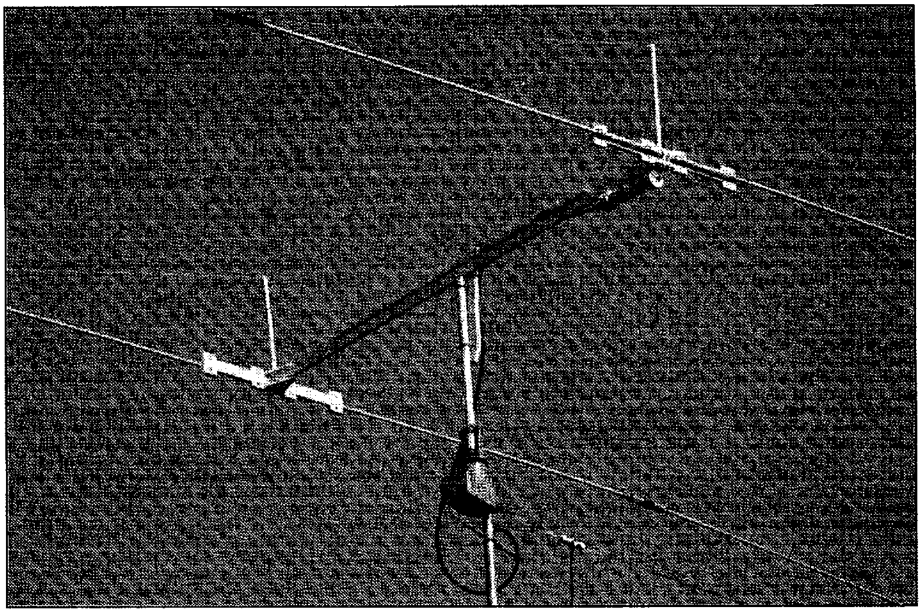

Photo A. The completed 20 meter mono-bander.

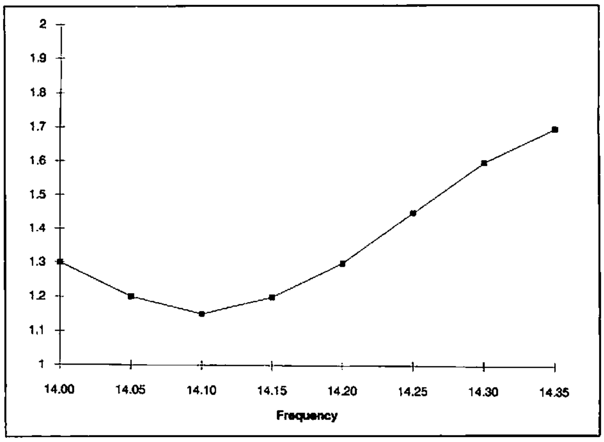

Figure 1. Measured SWR of the 20m shortened yagi.

Design Parameters

The main considerations and variables included the following important areas:

1. **Gain** This was paramount in importance, because they can't hear you if they can't hear you . . . Every available parameter was "tweaked" for maximum forward gain commensurate within the SWR and bandwidth constraints. The result is +10 dBi of forward gain at the frequency of interest, increasing to +11 dBi in the general portion of the band (albeit with reduced front-to-back) and decreasing to +9 dBi in the CW portion of the band. (See Figure 2.)

2. **SWR** An electrically-shortened antenna usually has low radiation resistance and requires a matching network of some type. I watched gain while decreasing the element spacing, at the same time varying reflector tuning and other parameters. I found I could match this antenna directly to 50 ohm coax using only a 1:1 wideband current balun. The balun was used to eliminate radiation from the transmission line and preserve the calculated patterns. I would have incorporated a gamma match if it would have helped, but

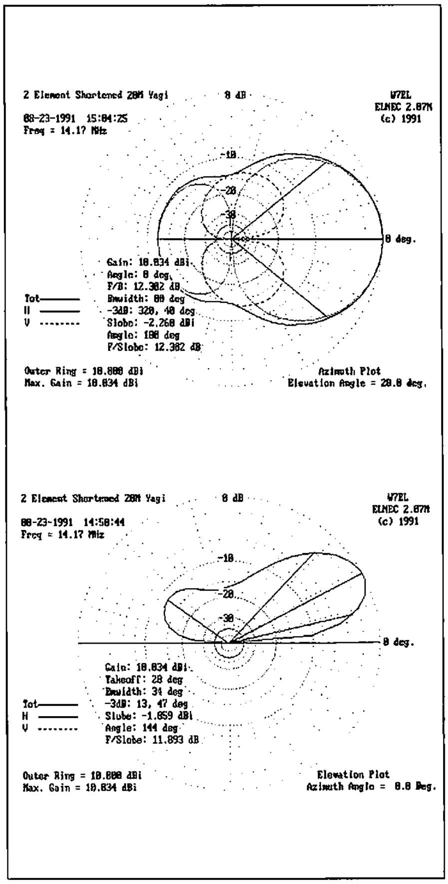

Figure 2. a) Azimuth plot of the yagi using the ELNEC program. b) The elevation plot.

believe me, this antenna is a good match to 52 ohm coax!

3. **Q (Bandwidth)** An electrically-shortened antenna also exhibits higher Q than its full-sized counterpart and this means less usable bandwidth. I wanted optimum performance, primarily within the frequency range of 14.150 to 14.225 MHz (where I hear much of the DX I'm interested in). I received an unexpected bonus when I modeled the antenna, and then constructed and tested it. Analysis showed a far better bandwidth than I had sought, and the finished antenna produced a full 350 kHz bandwidth with low SWR when measured at the transmitter end of the feed-line.

Subsequent remodeling and investigation suggests that the additional bandwidth results because of two reasons: Loading coil *Q* is lower than originally modeled (fortuitous because of the "low-profile low-wind-load" form factor I had chosen); and attenuation exists in the 50 feet of RG-8 coax needed to bring the antenna into the shack. You'll find that the attenuation of a random run of coax will yield lower SWR measurements at the transmitter than that measured directly at the antenna, and this serves to "pull down the end points" of the SWR curve. Figure 1 shows the broadband nature of this reduced size antenna.

The coax losses are sufficiently low as to be negligible for two reasons: The losses occur only at the edges of the frequency band of interest; and a tuner or matching network at the antenna also would introduce losses, and they would not be confined to band edges.

4. **Pattern** We'd all like to offer a "laser beam" to the world when we transmit, but I settled for reasonable front-to-back and front-to-side ratios with this antenna because of the constraints placed upon it. The front-to-back ratio varies from 12 to 18 dB, or 2 to 3 S-units in both calculated and on-the-air tests. With the Pacific to my back when beaming Europe or Africa, and the Atlantic at the flank when beaming the South Pacific and points west, it has proven to be a good choice. For stations at a reasonable distance, a distinct "null" appears off the sides of the antenna, probably due to the horizontally polarized signals predominating. (See Figure 2.) I'll admit that I placed pattern after gain when optimizing this yagi, but I have no difficulty determining when I point at a station (or its propagation path). This is very unlike a commercial "mini" I had occasion to operate from a friend's shack a few years ago, where it seemed we were turning a vertical! This antenna does have a usable pattern.

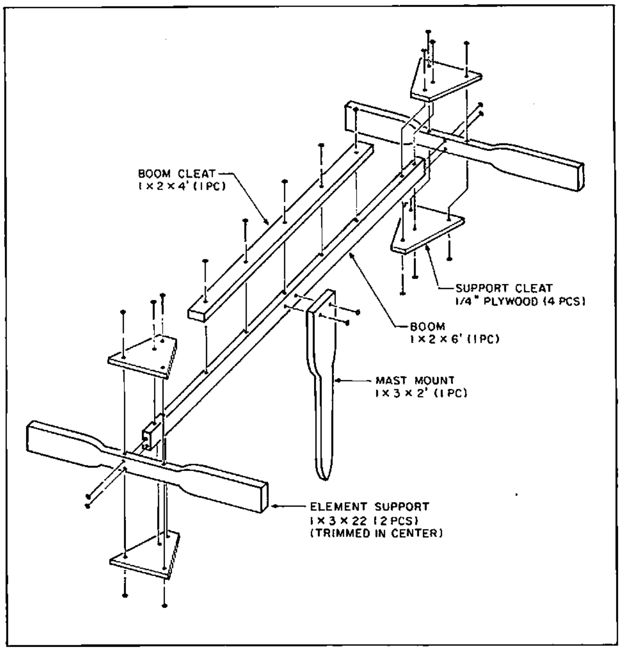

Figure 3. Boom assembly.

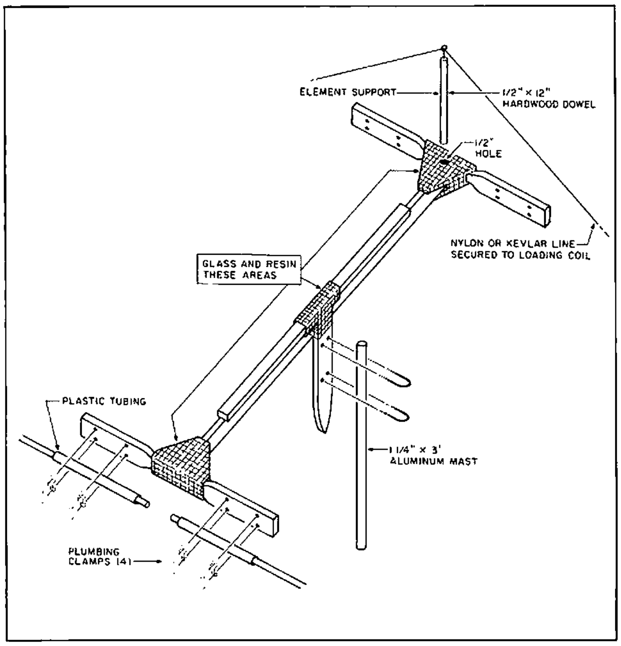

Figure 4. Glassing and final boom assembly.

Completed Design

Personal design constraint called for a total of 20′ element length, a spacing not to exceed 8′ (two elements), and maximum height above ground of 33′. The total antenna wind load and weight allow the use of an unobtrusive guyed push-up pole. The antenna that resulted from a few months of modeling on the computer has the following measured characteristics: element length = 20′; boom length = 6′; forward gain = 9+ dBi; F/S, F/B = > 12 dB; and full band coverage with less than 1.7:1 VSWR.

Compared to its isotropic counterpart and using 1,200 watts input, this antenna provides an average of 12,000 watts ERP in the direction it is pointed. After examining the performance of many commonly used "antennas" on my computer, this, I can assure you, is a very strong signal.

Construction

Since the antenna was to be as unobtrusive as possible, I chose a wood and aluminum design for maximum structural strength commensurate with small size. I used a wooden boom (common fir) and reinforced it with fiberglass cloth and resin. This allows a good degree of flexibility, strength, and light weight for "pole" mounting.

I constructed the elements from 1/2″ and 3/8″ aluminum tubing, available at many hardware stores in 6′ lengths. These diameters are very small as common yagi elements go and have survived severe Florida winds without problem. This is probably because of the elasticity or "springiness" of the wooden boom elements. You cannot appreciate the small "willowy" nature of this antenna until you construct it.

Construction begins with the boom itself, shown in Figure 3. It is not wholly necessary to glass the joints, but you assure long-term reliability if you do. Kits for glassing are available from your local department stores (such as K-Mart) or automotive shops. These inexpensive kits contain enough fiberglass

cloth and resin to complete this antenna, and a few more besides! After glassing the stress points shown in Figure 4, I used automotive primer and white automotive enamel (obtained where I bought the fiberglass kit) to spray the entire assembly for weather protection and unobtrusive appearance.

After the boom has cured, drill holes for the element mounting clamps, which are common plumbing clamps. Secure the 1/2"-diameter by 5'-long aluminum tubing to the element holders, also shown in Figure 4, spacing the ends of the tubing about 1" apart. Notice that I isolated the elements further from the boom mounts by slipping clear plastic tubing over the ends (also obtained from my local hardware store). You might wonder why I would bother to isolate elements when "plumber's delight" construction predominates in yagi construction, and I already had wooden insulating supports. Take nothing for granted, and KISS (keep it simple, stupid) are my mottos. I had analyzed the antenna as a set of free space conductors and that is what I wanted to build!

Connect the inside ends of the reflector with #12 wire and a pair of solder lugs screwed into the 1/2" tubing, shown in Figure 6. Be sure to weatherize these connections as well.

You can strap the Radio Works 1:1 balun to the boom near the driven element using one or two large stainless steel hose clamps. Connect the unbalanced output of the balun to the driven element ends, again using #12 copper wire, solder lugs, and self-tapping screws affixed to the 1/2" tubing. Be sure to weatherize these connections.

At this point, you have assembled the antenna as far as it can be and still fit in a normal garage. Subsequent assembly must be done outdoors, presumably on the day you will erect it.

Wind the loading coils on 1" wooden dowels, a total of 23 turns of #16 enameled wire spaced over 2.5 inches, for 4.2 µH of inductance, shown in Figure 5. Start by cutting a 1" wooden dowel into four 6.5" lengths, and then drilling a 3/8" hole into the ends of each dowel to a depth of two inches. Be careful to center the hole and keep the drill bit straight as it enters the dowel. A drill press and vise make the job easy.

After drilling the dowels, cut eight 5"-long pieces from a section of 3/8" solid aluminum rod. Mix up some "two-hour" epoxy, and after roughing one end of the rods with sandpaper, coat the rough end of each rod and insert it into the dowel until fully seated. Continue until all four dowels have 3/8" aluminum mountings at either end. This technique yields low profile, strong coil forms that you can easily attach to 1/2" tubing with hose clamps.

I used stainless screws and solder lugs, shown in Figure 5, to secure an electrical connection to the aluminum rods. I drilled small pilot holes through the wooden dowels at each end, continuing until the hole progressed into the rod. Wind the coils between the solder lugs and secure by soldering each end to its respective lug. To help in producing

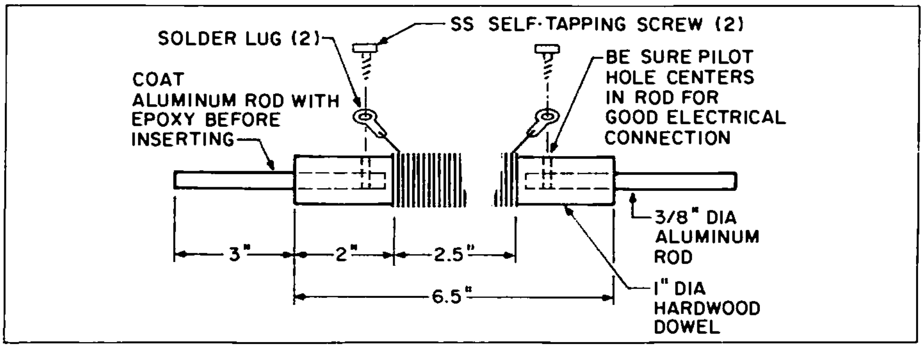

Figure 5. Loading coil assembly.

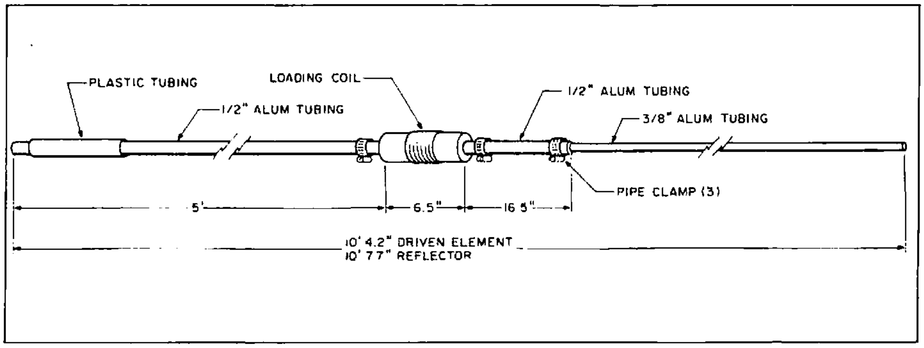

Figure 6. Element assembly (times four).

a uniformly wound coil, I used masking tape to secure the windings while I manually adjusted turns spacing with a thumbnail. This is very easy to do, and will only take a few minutes for all four coils. After the spacing looked uniform, I spread four thin beads of fast-curing epoxy down the length of each coil. I spaced the beads 90 degrees apart (the coils resembled B&W units at this point) and removed the masking tape when the epoxy cured.

The coil assembly must be weatherized, so I used 1-1/8" Teflon™ heatshrink over the entire length of the wooden dowels, and then sealed the ends with urethane. Alternatively, you can spray or brush the weather-resistant coating of your choice over the coil assemblies, making sure to seal the lugs and screws. The result will be loading coils that should last for a very long time.

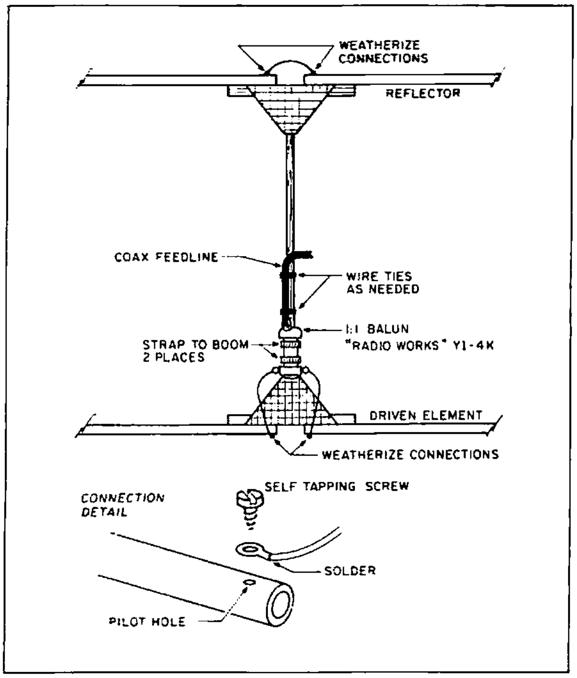

Figure 7. Final wiring.

Assemble the antenna elements by following the diagram in Figure 6. I used stainless steel hose clamps, but you can screw the element segments together, being sure to leave the four 3/8" end segments adjustable for tuning purposes.

Tuning

With the antenna lifted to the top of an 8' to 10' ladder, and using your rig at very low power (please don't cause QRM), simply tune the driven element to resonance at the center of your primary operating frequency. Adjust the reflector for a length that is 3.5" greater than the driven element on each side, or 7" longer overall. If you use the MFJ SWR Analyzer as I did, you can play around a bit with no fear of causing QRM. Repeat the process one more time and then recheck after raising the antenna to its final height. You can see from my SWR chart that I missed by a hint because of impatience. The antenna is usable over the entire band as tuned, and the high frequency side of the SWR chart does offer the highest forward gain... (excuses, excuses).

Antenna Mounting

To install the antenna, I used a 40' four-section push-up pole, a wall-mounting bracket, and a TV antenna rotor, all obtained from

Continued on page 46

The SAM1 Transverter

For the challenge of LF/VLF

by David Curry WD4PLI

Why would anyone ever want to work 1750 meters!? What possible excitement would such frequencies, that can be riddled with noise and strange propagational characteristics, offer anyone?

The answer is simple, and can be found in the calling that our radio ancestors experienced when they also marveled at radio, as most of us do now. 1750 meters is a band of antiquity. Electrically, long wave frequencies follow the same laws and principles that other frequencies do, but how and why they behave often seems peculiar and elusive. Challenges exist for the skilled amateur whose dive to the low frequency depths of 1750 meters to visit this once antiquated band of frequencies using a state-of-the-art transceiver and proper antenna, may be surprised by the opportunity that long wave operation has to offer. Old tube regenerative radios of that time stand in the shadow of today's highly sophisticated radio equipment and boast superior features such as IF shift and noise blanking that not only make the difference on our ham bands, but also make effective tools for amateurs who have "what it takes" for this true amateur band. Building a transverter such as the SAM 1 will allow you to enjoy top-notch reception of the entire LF spectrum from 5 to 450 kHz on your 80 meter transceiver, and transmit virtually any mode within the legal limits of the license-free 1750 meter band (160–190 KHz). This transverter design is in use by the 1750 meter Southern California net that meets every Saturday morning at 9 a.m., LSB. Stations hundreds of miles away are regularly monitored at my location under good conditions, while local stations only 30 miles distant can not be heard under poor conditions. This gives the obvious impression that this band can be one of extremes on many levels, and a challenge on all levels.

Enter the SAM1

The SAM1 transverter provides a practical way for anyone who has an 80 meter amateur transceiver to use the 1750 meter/long wave band in two-way communications. The third generation of transverters optimized by "lowfers" (anyone operating in the 1750 meter band) in the Los Angeles area, it uses only 10 transistors, one IC, and a few other parts.

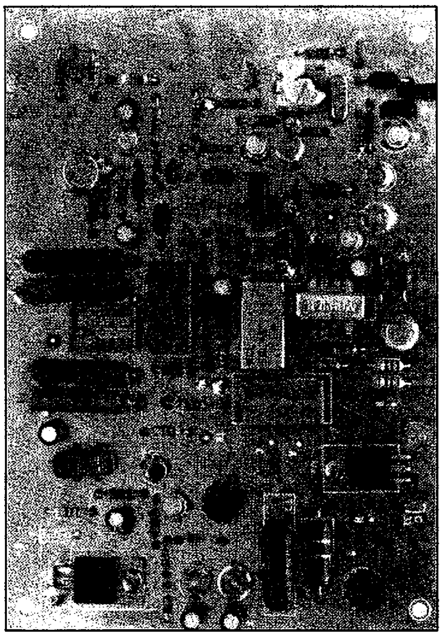

Photo A. The completed board.

With this transverter, you can operate all modes on long wave. You can also, while operating on long wave, have all the communication features, such as noise blanking, filtering, and speech processing, that are available on any HF or state of the art transceiver.

The transverter connects between any resonate 1750 meter/long wave antenna (a good choice is the "Dual-Band Vertical" in the September 1991 issue of *73*) and your transceiver, and operates on any well-filtered DC voltage supply between 12 and 24 volts (a 24 volt supply is recommended). The SAM1 has provisions for separate receive and transmit antennas and includes "phantom" power for remote active receive antennas or relays... or whatever! When you shut your SAM1 transverter off, automatic through-switching allows your transceiver to operate as normal, eliminating the hassle of connecting and disconnecting it.

The 1750 meter band offers a lifetime of interesting communications and challenge to appliance-weary hams looking for fresh soil, as well as to beginners and do-it-yourselfers who appreciate the art of building. Many have called it a "true amateur band." Wishing you and all the Southern California lowfers the best of luck on 1750 meters, I dedicate the SAM1 to Charles Faulkner, the father of the first practical transverter for regular SSB on 1750 meters in our area, and quite possibly in the U.S.

The SAM1 Transverter, Step by Step

See Figure 2 for parts placement, and refer to the table for parts identification, and let's go.... Be sure to use a good quality rosin core solder and a clean soldering iron tip.

1. Locate audio transformer T1. One side of the body is printed with the letter "P," which should match up with the "P" on the component side of the board. Insert all 6 leads and bend the transformer lugs for a tight fit.
2. Next, mount transistor Q7 (TIP31B). Bend the 3 leads near the body away from the top and insert them into the board. Line up the hole at the top of the transistor with the hole on the board and slip the small insulated gray washer in between. Clamp it tightly with a 4/40 nut and bolt (but not overly tight).
3. You can mount regulator U1 (MC7812CT) in the same way as Q7, but you don't need a washer.
4. Relays K1, K2, and K3 are next.
5. U2 is the doubly-balanced 8-pin mixer. Be sure to line up pin 1 with the dot marked on the circuit board.
6. Insert C14, the variable capacitor, so that the capacitor plates are located away from Y1. This gives room for inserting Y1.
7. Y1 (3.4995 MHz) can be inserted next. Be sure it's snugly mounted against the board while you're soldering.
8. Insert resistors R37–R40. Bend the leads close to the body, leaving the corners slightly rounded. Make sure that the bodies of the resistors stay at least ⅛" away from the board. They can get quite hot, and the space will help dissipate the heat. Solder all component ground leads on both sides of the board marked by an "S."
9. Insert and solder R31, R35, and R41. Notice the "S" marking where component leads are soldered on the component side to insure a good ground connection. Resistors R1, 8, 9, 14, and 21 must be checked for this.
10. Next come diodes D1, 2, and 3. Notice the band marking on the diodes before inserting, making sure to match up the band on the

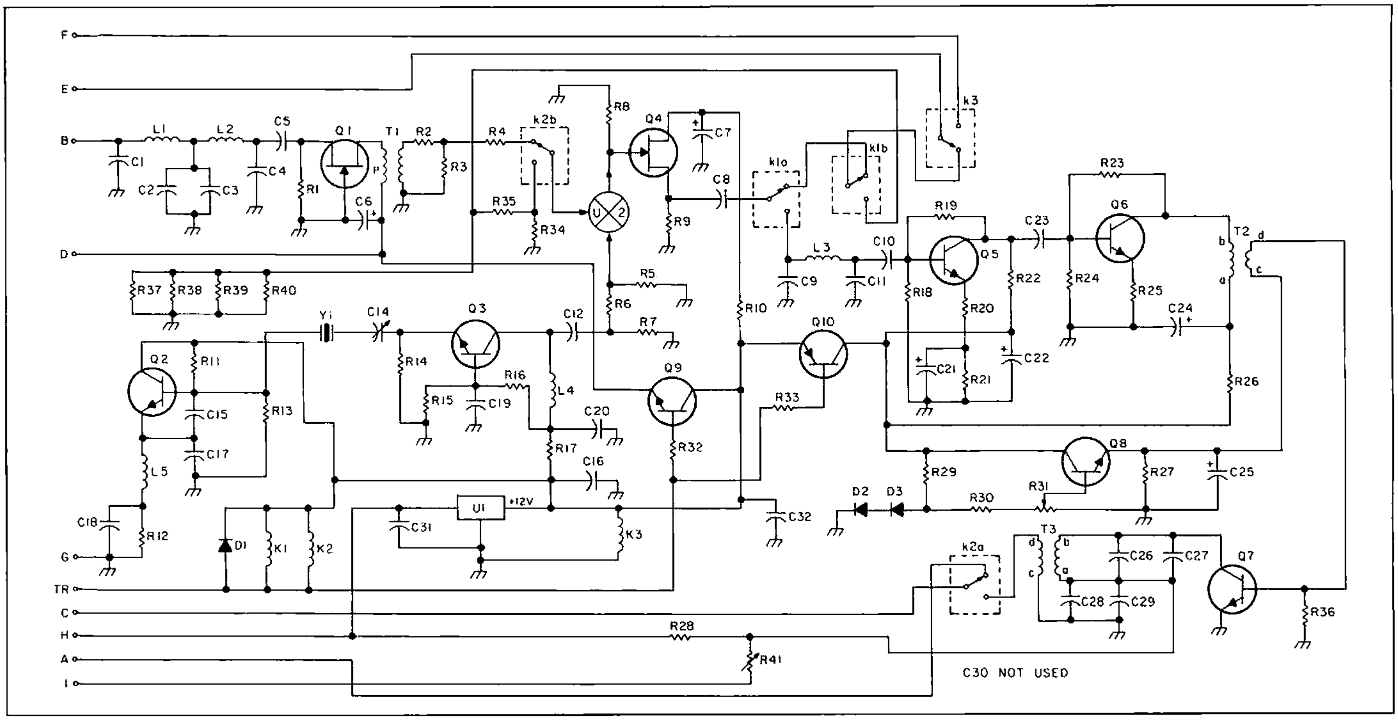

Figure 1. Schematic of the SAM1 Transverter.

part with the parts placement diagram. Diodes D2 and 3 should be directly against the board, nice and snug.

11. Insert and solder all capacitors, going right down the parts list, starting with C1 through 3, 4, 26, and 27. Do one section or type of part at a time, to avoid mixing them up. Solder and clip leads when done with each type. Notice that C5, 6, 7, 24, 25, 28, and 29 are electrolytic, so pay careful attention to polarity when installing them!

12. Inductors L1, 2, 3, 4, and 5 are mounted away from the board about ⅛" to avoid any possibility of shorting one of the fine wires. Notice the inductor part number for correct part insertion.

13. Transformers T2 and T3 are both toroid transformers (see the parts list for winding details). The smaller toroid should be inserted at the T2 location. Mount the toroid on its side, with the secondary wires going to the holes marked C and D, and the primary wires going to holes A and B. With fine sandpaper, carefully strip the enamel insulation from all four wires next to the body of the toroid, leaving the bare wires ready for soldering on the foil side. Pull each wire so that the toroid is snug against the board. Then mount transformer T3, also on its side, with the secondary wires going to holes C and D, and the primary wires going to holes A and B. Strip and pull the correct wires through the marked holes, and solder all four. Clip excess leads. Both T2 and T3 should rest snugly against the circuit board.

14. Transistors Q1 and 4 are FET devices and should be handled carefully. Notice the positioning of the part with reference to the outline on the board. The "g" marks the gate of both FETs. Insert and position the body of each FET about ¼" from the circuit board. Solder all six leads on the foil side and clip excess. Also solder the "g" of Q1 to the ground plan marked by letter "S." DO NOT use an excessive amount of heat.

15. Remaining transistors may be done next, in the above manner. Notice Q6. The base lead, or the middle lead on the part, should be bent and inserted across the board. Leave ⅓" or so from the body to the board for the part. Check that the TABS of all transistors match the TAB drawn on the board.

16. Visually inspect the bottom of the board, looking for any possible solder bridges or cold solder joints. Inspect the TOP or component side of the board against the layout diagram and parts list to ensure proper part location. The circuit board is now complete.

Operating the Circuit

The SAM1 is a basic transverter design with a few interesting tricks that greatly improve performance. On the schematic, follow the receive path from input C1.

C1, 2, 3, and 4, and L1 and 2 form a 5-element, low-pass network that greatly attenuates all frequencies above 480 kHz. This is desirable to prevent overload from local AM broadcast stations and to minimize any IMD. Below this frequency, all signals are allowed to pass with a minimum of insertion loss. The phase and filter curve is included in this manual. C5 is a DC blocking capacitor, so that operation of Q1 will be maintained. Q1 is a low-noise, 12 dB amplifier operating in the classic grounded-gate configuration for best stability. In parallel with R1, it provides a 50 ohm input at the source for the filter.

T1 transforms a load of 450 ohms for the drain of Q1 to a nominalized value of 50 ohms. A 50-ohm "T" pad consisting of R2, 3, and 4, with an attenuation value of 1 dB, provides stability and improved return loss for mixer U2. Local oscillator Q2 is the classic Colpitts circuit, with C14 adjusting the frequency of crystal Y1. Typically, the output of such an oscillator is usually taken from where L5 and the emitter of Q2 connect, and the end of C14 would go to ground. However, in this arrangement the end of C14 goes instead to the very low input resistance of common base amplifier Q3, which when in parallel with R14 has an input resistance of less than 10 ohms. This is important because any significant resistance in series with crystal Y1 would spoil Y1's Q.

With such high Q (over 1000), a simple crystal filter is formed with an extremely narrow bandwidth (less than 10 Hz). We can attenuate local oscillator harmonics by as much as 60 dB, and cut our noise floor down to −110 dB! Q3 works as a stable low-noise amplifier, taking the −2 dBm signal output of Y1/Q2 and amplifying it to an acceptable level of 9 dBm. Inductor L4 and capacitor C12 form a resonant "L" network, matching the collector impedance to the 50 pi attenuators R5, 6, and 7, at 3.5 MHz. The attenuator network provides optimum stability and good return loss for mixer U2.

While the receive amplifier Q1 is only on during receive operation, Q2 and 3 operate during both receive and transmit. U2 acts as both the receive and transmit mixer. Buffer stage Q4 simply provides optimum isolation between U2 and any other stage connected through C8. Resistor R8 is a broadband 50-ohm termination for U2 at all mixer frequencies and harmonics.

This configuration has a small loss (approximately 2 dB); however, using a true 50-ohm termination for U2, with good insulation between U2 and the next section, the advantages outweigh the disadvantages. Q4 operates as a typical source follower with a 50-ohm output across R9. C8 is simply a DC blocking capacitor.

K1A and B are part of the switch-over team

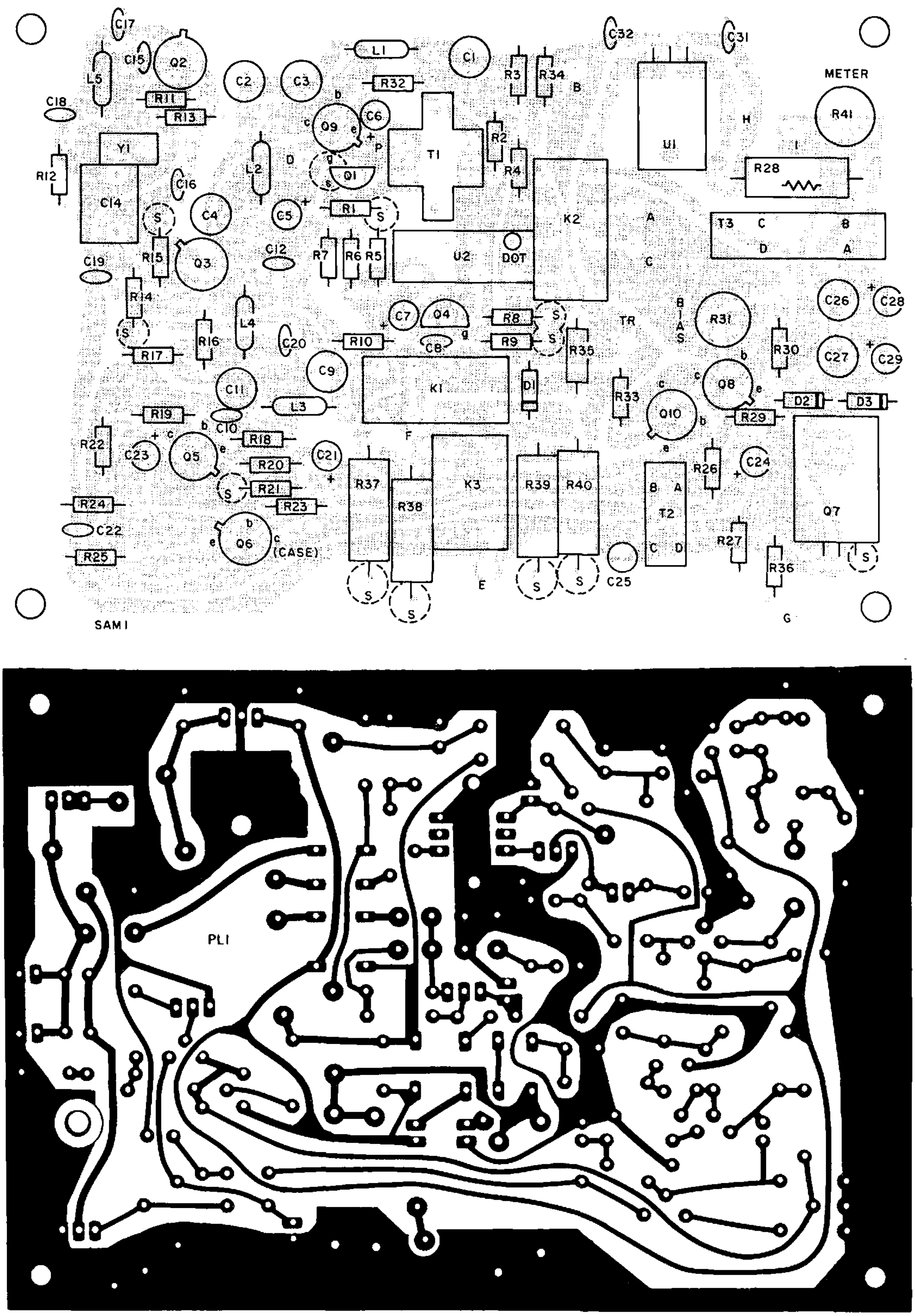

Figure 2. Parts layout and foil diagram, from the component side of the circuit board. Be sure to use a good quality rosin core solder and a clean soldering iron tip, with a wattage of 25 to 60 watts.

that transfers the output from C8 to either your receiver input through point E or to the 1740 meter amplifier and low-pass matching filter, starting with C9. The received signal is simply the *sum* of the local oscillator frequency (3.5 MHz) and the low frequency input at point B (5–450 kHz). All signals within the low frequency spectrum are mixed together with the local oscillator, providing *sum* (3.5 MHz + LF) and *difference* (3.5 MHz - LF) frequencies and their harmonics.

The *sum* frequencies are those being received on the 80 meter transceiver, while all *difference* frequencies are simply ignored. You might say that half the signal power (−3 dB) is lost because, as the signal is converted, it is split in two, one half being the *difference* and the other half being the *sum*. This is one reason that the doubly-balanced mixer, U2, has an approximate loss of 5 dB and extra amplification (Q1 and 3) is needed to overcome the loss.

The Transmitting System

The SAM1's transmitting system is a simple broadband design that uses many of the same stages of the receive circuitry to save space and, of course, money. Point TR is used to activate relays K1 and K2 that switch over the input and output ports of mixer U2. When TR is grounded, the relays close, switching the input of mixer U2 to the 40 dB attenuator transmitting pad, consisting of resistors R34, 35, and 37–40. The pad will dissipate virtually all the power from your transceiver, allowing only a very small signal of 0 dBm to reach the mixer.

The 50-ohm pad also helps minimize IMD and the return loss characteristics of U2. The low-level RF signal from your 80 meter rig (between 3.66 to 3.69 MHz) is mixed with the local oscillator output from Q3, leaving the *sum* and *difference* frequencies across R8 and the input-to-source follower circuitry provided by Q4.

Again, R8 is the optimum match for U2, with a pure 50-ohm nonreactive load for these relatively low frequencies. With relay K1 closed, the output at the source of Q4 is connected to the pi matching circuitry of inductor L3 and capacitors C9 and 11. The pi match gives good attenuation of all harmonics of the *difference* signal from the mixer and eliminates all *sum* frequencies and their harmonics. It also provides a good match from the 50-ohm source of Q4 and R9 in parallel to the 600-ohm input impedance at the base of Q5. Both Q5 and 6 operate in a broadband class A mode, simplifying system design. With the elimination of frequencies above and beyond 240 kHz by the pi match, the two-stage broadband amplifier of Q5 and 6 gives about 20 dB of gain of the *difference* frequencies that fall within the 1750 meter spectrum.

As an example, an HF transceiver that transmits a signal at 3.6 MHz mixes with LO in U2 (3.675E6/3.5E6 = 175 kHz), and presto, you have your signal right in the middle of the 1750 meter band at 175 kHz!

Q6 will run very warm because it is biased to allow good linearity of voice peaks. The output of Q6 is transformed to an impedance level of 40 ohms through the action of trans-

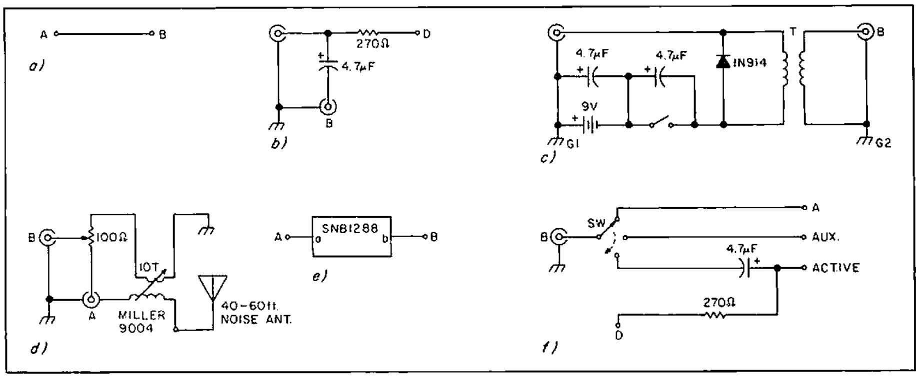

Figure 3. Noise-eliminating circuits: a) using the transmitting antenna; b) using "phantom power"; c) same as "b" but the DC supply and ground remain independent of the transverter and house ground; d) phase-canceling device; e) the SNB1288 synchronous noise blanker; and f) a switching arrangement for three antennas.

former T2, which is also operated in a broadband manner.

Transistor Q7 is a hefty 30-watt device, deliberately used here to overcompensate for mismatch conditions. Q7 is normally operating the class AB or class B mode with good gain and acceptable linearity for voice communications. Under ideal circumstances, efficiency has reached as high as 70%. Output power in the neighborhood of 10 watts is also possible, but discouraged. The heat sink for Q7 will not accomodate this; if you use the device incorrectly, you may destroy it.

You can adjust the bias potentiometer R31 for zero volts of bias to Q7 for class C operation, if you wish. The bias transistor Q8 is a simple current amplifier/voltage regulator, providing a bias potential from the emitter through the secondary of T2, where the RF signal is added to the bias voltage and over to the base of Q7.

Diodes D2 and 3 provide a steady 1.2 voltage reference for R31, which you adjust to set the idle current through Q7 to approximately 10 to 15 mA. The amplified output from the collector of Q7 is applied to tank circuitry of transformer T3 and capacitors C26 and 27. C25, 28, and 29 create a virtual short for all RF in the PA section. The output impedance of transistor Q7 and the 50-ohm load connected to the secondary (your antenna) via point C, dampen the *Q* of T3 so that full coverage and more across the 1750 meter band is possible. Excellent linearity and harmonic attenuation are found using the carbonyl HP material in this toroid.

Resistor R36 is not normally used, but if you experience any problems with oscillation of Q7 during transmission, a resistor with an approximate value of 47 ohms, or even lower, may be placed in this spot. Be careful not to use too low a value, though, since this will load down transistor Q8, which may burn out.

System Operation

All interconnections to the SAM1 are done through points on the circuit board (see the schematic). Let's look at each point and examine what each one is used for.

A: 1750/LF "thru" port. In receive mode, the transmitting antenna connected to port C will go to point A. This point can be connected to point B for using the transmitting antenna for receiving, or left unused if a separate antenna for receiving is desired.

B: 1750 meter receive input port. 50-ohm input for long wave and 1750 meters.

C: 1750 meter transmit port. Used for connection with 1750 meter transmitting antenna. You can also use it for 1750 meter receiving if you wish to use the same antenna for both.

D: "Phantom" power during receive operation. Provides 12 volts DC for accessory connections. Voltage goes off during transmit. 200 mA maximum recommended current.

E: 80 meter transceiver port. Using coax cable, connect this port to your 80 meter transceiver. Miniature coax is acceptable. Ground the braid of the coax to the ground plane on the component side of the circuit board, next to the hole where the center conductor of the coax is connected.

F: Transceiver "through" port. When the transverter is off, relay K3 will also turn off, allowing regular use of your transceiver at port F. Regular antenna connections that would normally go to your transceiver SO-239 jack should go to port F instead.

G: Ground. Use this point for a good ground connection.

H: VCC. 12-24 volts DC. Well-filtered, 24 volt supply recommended.

I: PA meter terminal. Negative connection for using a milliamp meter for monitoring input current to the PA. Positive connection should go to point H. You can use almost any type of milliamp meter, but I recommend one with a range of 1 mA. Calibrate the meter with R41. You can make PA current measurements with any VOM, VTVM, or digital meter, measuring the voltage across points H and I after adjusting R41 for minimum resistance.

TR: Transmit/Receive switch. Turns transverter from receive to transmit. By grounding this point, the transverter system will go into transmit mode. This point should go to your transceiver's auxilary relay for automatic switch over. Consult your transceiver's manual for correct connection. Connect the normally open relay terminal on your transceiver to point TR and the common relay point going to ground. This will automatically switch both systems over at the same time. For manual operation, you can switch between point TR and ground.

Optional Circuits

Once you have built your transverter, mount the board inside a suitable housing with appropriate connectors and switches. Use quality RF connectors, such as SO-239s or BNCs to simplify interconnections to other pieces of equipment. You have to decide whether you want one antenna or more than one, and whether you want to add noise-eliminating circuitry, such as the options shown in Figure 3.

Figure 3a shows a simple connection to turn the 1750 meter transmitting antenna into a receiving antenna. Just solder a wire jumper from points A and B. Figure 3b is a basic circuit for using "phantom power" to supply an active whip or other remote device, and to separate the signal to point B, the LF receive port. The unmarked port in Figure 3b should connect to RG-58AU coax or similar shielded cable, to carry both the RF and DC power to the remote device.

Another possibility is shown in Figure 3c, which is the same as circuit 3b except that the DC supply and the ground remain independent of the transverter and the house ground. This is important because a lot of the noise that plagues reception can be traced to the ground system. Frequently, many ground systems are "dirty"; they carry pow-

VLF Information Sources

The Longwave Club of America 45 Wildflower Rd. Levittown PA 19057	Membership is $12/yr ($20 foreign) which includes a subscription to the Lowdown which promotes DXing and experimentation on frequencies below 550 kHz and the 1750m band.
The Northern Observer c/o Herb D. Balfour 91 Elgin Mills Rd. West Richmond Hill, Ontario L4C 4M1 Canada	$15 donation (U.S.) for this newsletter with information about LF, VLF, ULF, MF and some HF operations in the east coast, mid-west, central states and Canada.
Western Update c/o Jim Ericson 226 Charles St. Sunnyvale CA 94086-6063	Western newsletter for MF, LF and VLF experimenters. $10/yr or $1 per issue (with 25 cent stamped envelope).

SAM1 Transverter Parts List

Resistors

R1,14,21	270Ω	R10,17,20	33Ω	R22	180Ω
R2,4	3Ω	R11	82kΩ	R24,30	470Ω
R3	430Ω	R12, 33	1kΩ	R25, 26	12Ω
R5,7	910Ω	R13	22kΩ	R28	1Ω 1W
R6	6.2Ω	R15,19,23	2.7kΩ	R31	2k pot
R8,27,34	51Ω	R16	6.8kΩ	R32	2kΩ
R9,29	560Ω	R18	1.5kΩ	R35	4.3kΩ
R36	NOT USED	R37–40	200Ω 6W	R41	1k pot

All resistors are ¼W unless noted.

Capacitors

C1,3,4,26,27	0.01 µF, 50 VDC poly
C2	0.0047 µF, 50 VDC poly
C5,6,7,21,23,24,25,28,29	4.7 µF, 35 VDC, electrolytic
C8,10,16,18,19,20,31,32	0.1 µF/50 VDC monolythic chip
C9	0.022 µF/50 VDC monolythic chip
C11	0.0082 µF/50 VDC monolythic chip
C22	1 µF/50 VDC monolythic chip
C15	68 pF NPO
C17	270 pF NPO
C12	390 pF S.M.

Inductors, Transformers

L1,2	27 µH Inductor J.W. Miller #70F275AI
L3,5	120 µH Inductor J.W. Miller #70F124AI
L4	5.6 µH Inductor J.W. Miller #70F566AI
T1	200:8Ω audio transformer Mouser #42TL004
T2	FT-50-77 toroid. Primary: 45 turns #28 wire. Secondary: 6 turns #22 wound over primary.
T3	T68-3 toroid. Secondary: 61 turns #28 wire. Primary: 46 turns #28 wound on top of secondary.

Transistors and Other

Q1,4	J310	U1	MC7812CT
Q2,3	2N2857	U2	SBL-3
Q5,8,9	2N2222A	1	Q7 mica insulator
Q6	2N2102	1	4/40 nut and bolt for Q7
Q7	TIP31B	K1,2	DPDT 12 VDC relays, 8-pin Digi-Key #Z440-ND
Q10	2N2907A	K3	SPDT 12 VDC relay, 5-pin Mouser #ME431-1212
D1	1N4001	D2,3	1N914A

A kit is available from Curry Communications, 737 N. Fairview St., Burbank, CA 91505. Tel: (818) 846-0617. It includes JFETs, so be sure that your soldering iron is grounded—and your body, too! No milliamp meter is included. Options for using the SAM1 with other equipment, and articles on recommended antenna designs, come with the kit. The silk-screened component side of the circuit board is marked for parts placement. The complete kit costs $89.95. The silk-screened, double-sided, predrilled board alone is available for $19.95 postpaid.

er line hash and the remains from light dimmers (G1).

Active whip antennas, for example, have an extremely high impedance and couple easily to local structures, wires, and of course, to the braided shield of the coax delivering power to the active whip. Noise along the grounded braid is capacitively coupled to the antenna, wrecking the signal-to-noise ratio in an otherwise quiet area. For a separate (G2), "clean" ground independent of the house or system ground, put a rod or similar item directly under or near the active whip and connect it to the active whip circuitry as shown in Figure 3c.

Transformer "T" is made by winding 50 turns for both primary and secondary on an Amidon FT-82-77 coil form with #32 gauge wire. The polarized capacitors can be any value from 1 µF to 10 µF electrolytic. A battery supply is highly recommended. If you decide to use an active whip, which is quite effective as a receiving antenna, be sure to place it away from power lines and buildings. Often the best places for this type of antenna are in the front yard, on a wooden pole on the roof, or at the top of a tree.

Figures 3d and 3e are both noise-canceling devices. Figure 3d uses phase canceling, which can be highly successful for power line hash or complex noise. The noise antenna can be any length of wire from 40 to 60 feet, laid horizontally on the floor or outside on the ground. The goal, of course, is to maximize noise on the noise antenna by placing it near house wiring where it will couple to the wiring and radiate noise. You'll need to experiment with this circuit to get the best results, since noise at each location is different.

J.W. Miller coil #9004 is used to resonate the noise antenna at the frequency of interest (in this case, in the 1750 meter band). The secondary of the transformer uses a low impedance of only 10 turns; that is, 180 degrees out of phase. Antenna input at "A" contains both signal and noise, and the noise is canceled by rotating the 100-ohm potentiometer to a point where the noise is of equal and opposite current, and adjusting the resonance and phase with the Miller inductor.

Vertical resonant antennas work well at port "A". Figure 3e is the Curry Communications SNB1288 synchronous noise blanker, which can be inserted between points "A" and "B" of the SAM1 transverter as shown. This will eliminate all types of synchronous noise, such as light dimmers, and could even be added in series with the phase-canceling circuitry in Figure 3d (point "B" in 3d going to point "B" in 3e, and point "A" in 3e going to point "B" on the SAM1). Don't forget that "A" in Figure 3d goes to point "A" on the SAM1. So you can see that there really are many ways to do it.

This leads us to Figure 3f, which shows a switching arrangement capable of letting you use three different antennas, which could be quite convenient. This switch is recommended with one or both of the noise-canceling devices in Figures 3d and 3e. If you live in a suburban area, you can almost bet that light dimmers and similar devices will plague reception, and the noise blanker on your HF transceiver may not have a long enough time constant to eliminate these pulses. First check your reception to decide how elaborate you want to get with these receiving aids.

Once you have decided on the system, if any, you wish to use with the SAM1, and you've decided on how you want to mount the circuit board, remember to use ¼" spacers when you position the board inside the housing. Anything under ¼" may short the screw or bolt on Q7, which has full potential.

Connect the power supply to points G (ground) and H (positive). A 24-volt DC supply is recommended, but a 12-volt supply is adequate. When the SAM1 is properly connected, relay K3 will close.

Bias and Oscillator Adjustments

At this point, align the bias and PA meter. Rotate R31 fully counterclockwise (bias control) for minimum bias voltage on Q7. R28 is used as a current reference so you can accurately measure and monitor the PA current of Q7. A meter would be the easiest way to do this, using 1 mA across points I and H. Adjust resistor R41 to align the meter for a calibrated indication. Use a VOM or digital meter and connect leads across R28. Apply power to the SAM1. You should hear relay K3 close when you turn the power on. If you don't, your power supply potential is too low and you have to increase it.

Place the SAM1 in the transmit mode by grounding the TR point. Relays K1 and 2 should change over, and you may get a reading of 1 mA or so across R28. Remember that the VOM or digital multimeter is actually measuring the voltage across R28, but because of the resistance of R28 (1 ohm), you can interpret the reading as the actual current flowing through R28 to Q7. R31 is rotated slowly clockwise for an indication of 10 mA (or 0.01 volts measured across R28). If desired, you can use a jack or plug and simply monitor the current externally with a VOM or multimeter. Use points I and H, adjusting R41 for minimum resistance. Any meter other than a multimeter or VOM will have a

significant amount of resistance, and R41 compensates for this.

Some meters can measure up to 300 ohms of internal resistance, and you can calibrate a meter of this type simply by monitoring the current across R28 with a VOM or digital multimeter and turning R41 so the current on the meter will be the same as the current across R28. This concludes the bias adjustment of the SAM1.

Unground point TR and connect point "E" to the RF terminal on your HF transceiver. Zero beat the local oscillator on the SAM1 by tuning your HF transceiver to 3.5 MHz and rotating C14. If you own a calibrated frequency counter, you can check the frequency of the local oscillator at the output of Q3, or across C12 or L4. Make sure your transceiver is calibrated to the internal oscillator most modern HF transceivers are equipped with. If your transceiver has one, turn the oscillator on and zero beat the two signals, listening in the AM mode.

Checking Connections

With all connections to the SAM1 completed, check to make sure the points on the SAM1 are going to their correct places on the transceiver and antenna. Apply power and again listen to make sure you heard relay K3 kick over. Your HF transceiver will operate just as it would on any amateur band, along with any controls you wish to use to improve the reception or transmission within the 1750 meter band. The readout on the analog dial or digital display is simple to read: Ignore the 3.5 MHz; read only the kHz readout.

For example, let's say you're working an SSB station on 183 kHz. What would the readout be on your transceiver? Simple: 3.683 MHz; 3.683 - 3.5 = 183 kHz! Shortly you will become accustomed to ignoring the 3.5 MHz and the fact that your HF transceiver has been transformed into a complete LF/VLF station.

Make extra sure that the TR point on the SAM1 board is connected to the external relay port on your HF transceiver so the SAM1 will automatically follow the transceiver going from receive to transmit. Check this by placing the transceiver in the send or key-down (transmit) mode, but don't let any RF leave the transceiver.

Keep all carrier and mike controls on the transceiver to a minimum! Both relays (K1 and 2) on the SAM1 should key over. If you do not hear this, your wiring on the TR line is incorrect. Point TR must be grounded during transmit mode. If all is well and the relays key over, you're ready to check the transmitter half of the SAM1. Be sure to connect a *resonant* 1750 meter antenna to point "C"on the SAM1, or a 50 ohm, 2 watt load resistor as a termination. With both the transceiver and transverter in the transmit mode, send a low-level carrier of approximately 10 watts on the transceiver anywhere between 3.66 to 3.69 MHz (160 to 190 kHz), the legal band limits of the 1750 meter band.

Check the PA current of the SAM1 as discussed previously. The legal input power for continuous duty or CW to the PA is 1 watt. Not much, but surprisingly effective! Hundreds of miles have been successfully and regularly worked on such low power, which adds to the challenge of the 1750 meter band. When operating SSB, however, 2.8 watts peak-to-peak is allowable, and the transverter can handle this easily.

The bias current to Q7 is adjusted to a class AB condition (15 mA) to accomodate SSB operation. The drive level from the HF transceiver controls the RF output of the SAM1, with only a small amount (10 watts) required for legal output on 1750 meters. With too much power or a too-high bias, transistor Q7 can go into thermal runaway. The bias will naturally increase as the temperature of Q7 increases, so don't be concerned about this. Temperature-tracking diodes D2 and 3 are help minimize this condition.

Because of their continuous duty operation, digital modes such as RTTY and AMTOR require that you keep the drive to the SAM1 low. Check the PA current to Q7 often. If desired, you may lift Q7 from the circuit board and set it down vertically, with a heat sink attached to the metal body for improved heat dissipation. The TIP31 transistor Q7 is quite rugged; because of this virtue, I chose it as the PA amplifier.

David Curry WD4PLI, 737 N. Fair-view St., Burbank CA 91505. (818) 846-0617.

Monoband Yagi

Continued from page 35

Radio Shack. I mounted the antenna at the top of the pole, with the sections uniformly telescoped to yield a total height of 30 feet. I obtained additional strength by telescoping the sections to this shorter length. A short mast cut from 1-1/4" aluminum tubing and mounted above the rotor brought the total antenna height to 33 feet. If you use a pole, as I did, don't attempt to extend the pole to its maximum height. Very little will be gained in radiation angle, but the structure will be weakened considerably.

I attached the pole to my eaves at a height of 10 feet using the mounting bracket. I then guyed the pole near the top using Kevlar™ line sheathed in Dacron™ (available from Radio Works). This produces a strong, inconspicuous guying system.

Performance Tests

In three months I have logged 107 countries with the new antenna, most of those on SSB and most with signal reports of 5-9 or 5-9 plus. "Big Signal, AB4GX" has commonly been heard. The power used varied between 50 and 1200 watts output, although the antenna should handle full legal power with no problems. The front-to-back-ratio agrees with the computer analysis, and I've used the existence of the null off the sides to advantage. When working East (Europe and Africa) or West (South Pacific or Asia), I can effectively null the strong South and Central American stations adjacent to my Florida QTH.

This is the first time in 27 years of hamming that I have used a yagi, and the first occurrences of QSOs interrupted by hams telling me that there must be "something wrong with your equipment because you are pinning my S-Meter and blocking my receiver." This sometimes while barefoot, and while I have ended QSOs in the interest of peace and harmony, I have also developed a new respect for the gain of this antenna. I have found I can work almost anyone I hear, most often on the first call, and power management coupled with operating courtesy are much more visible requirements. You cannot have a "Big Signal" without also having a "Big Responsibility." And all this on a push-up pole, and with shortened elements! Enjoy, and please let me know your experiences if you construct this "residential yagi."

Parts List

QTY	Item
2	½" x 12" hardwood dowel
4	1" x 6.5" hardwood dowel
1	1-¼" x 3' aluminum mast pipe
4	½" I.D. x 1' clear plastic tubing
4	½" diameter x 5' aluminum tubing
4	½" diamater x 16.5" aluminum tubing
4	⅜" diameter x 4' aluminum tubing (cut for proper length, as shown in Figure 6.)
8	⅜" diameter x 5" aluminum rod
2	1-¼" I.D. U-bolts for mast
8	plumbing clamps for ½" pipe
12	pipe clamps for ½" pipe
1	1" x 3" x 24" pine
1	1" x 3" x 22" pine
1	1" x 2" x 4' pine
1	1" x 3" x 6' pine
1	1' x 1' x ¼" plywood (cut up for the 4 cleats)
	#12 wire
	#16 enameled wire
1	1:1 balun - Radio Works #Y1-4K
	Kevlar support wire - Radio Works
12	self-tapping screws
12	eyelets
1	Fiberglas kit (optional) - K-Mart or equivalent

Contact Ken Kemski AB4GX at 3745 Allenwood Street, Sarasota FL 34232.

73 Review

by Thomas Gould WB6P

The EASY-PC PCB Layout Program

Easy PC PCB Layout System
Number One Systems Ltd.
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PE17 4WR England
Telephone: 011 44 480 61778
Fax: 011 44 480 494072
Price Class: $200

An easy way to produce camera-ready PC board artwork.

EASY-PC, from Number One Systems Ltd., is a low-cost computerized printed circuit board layout system. With this program you can generate camera-ready PC board artwork from a dot matrix printer or plotter. That function alone makes the program worth the cost, but what really interested me was the ability to generate Gerber Data, allowing you to have your artwork plotted on a photo plotter, which provides excellent quality artwork at a very minimal cost. Also included in the package is a schematic drawing tool.

EASY-PC is a PCB artwork generation program that takes the place of the old way of using artwork tape and pads on mylar for artwork. The great advantage of the computer is that it allows you to make changes easily. Instead of having an assortment of layout templates for each part on your circuit board, you have a library of parts which you can place on your layout, move around freely and copy as much as you want.

EASY-PC will allow boards up to 17 inches square. Your board can have up to eight track layers and a top and bottom silk-screen. The monitor display shows the true track width and pad size. You can virtually set any track or pad size. There are full library construction utilities to allow the user to generate any geometrical shape needed for a part. There is a limited set of common parts supplied in the library.

The EASY-PC program can also be used for schematic drawing, but there are no utilities such as parts list output, etc. There are three utility programs for output from EASY-PC. These are Easygerb for the gerber output. Easyplot for plotter output: and Easydrill for NC Drill output data.

Using EASY-PC

EASY-PC requires an IBM PC, PC-XT, PC-AT /PC 386 or equivalent running DOS 2.0 or later, fitted with a Graphics Adapter CGA, EGA or VGA and an appropriate monitor (preferably color if double-sided or multi-layer boards are to be designed). A minimum memory of 512K bytes is necessary. The programs work on a VGA system in the EGA mode. EASY-PC does not support Hercules Mono graphics. A mouse is not essential, but the program works better with one.

The documentation is quite complete. There is a tutorial which guides you through a

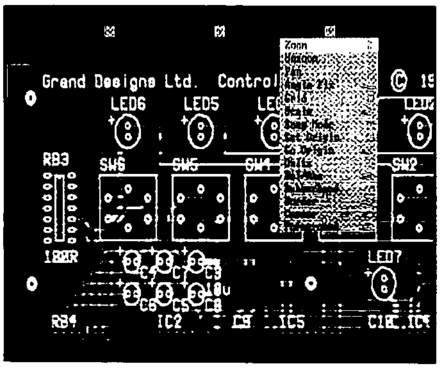


Photo A. The Easy-PC can support the design of complex multi-layer PC boards. Pull down menus along with hot keys make board design a snap.

sample circuit board to give you a flavor of the command set. For various commands you can either use the pop-down menus or use the template to enter the command sequence through the keyboard.

Zooming in and out is very fast. There are eight keyboard-selectable fixed zoom levels which allow you to quickly set the magnification you desire. The screen refresh rate time varies depending on how much information has to be drawn. With a little experience you can display only the layers of interest at that time and speed up the screen refresh rate.

The cursor x,y coordinates are displayed on the lower left of the screen display. The units can be either in thousands of inches or in

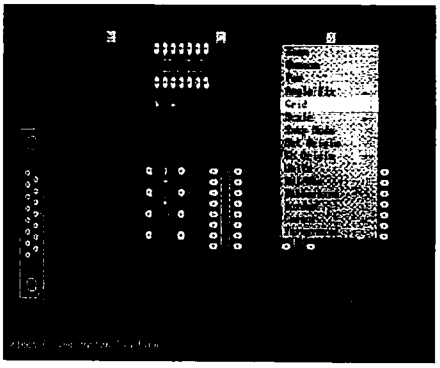


Photo B. The various layers of the PC board are represented by different colors. Here the blue layers represent the bottom layer, the red layer is the top layer and the white layer shows the silk-screened labels.

millimeters. The program also supports relative or absolute coordinates. The x,y coordinate origin can be set anywhere within the 17-inch-square border.

Library symbols are easy to generate and modify. The program has a save reminder which can be programmed to warn the user to save his work at preset time intervals.

Laying down pads is very straightforward. You select the new pad command and place a pad where the cursor is. Then you can change the variation of that pad to many different types. To continue, you just move the cursor to the new pad location, click the mouse, and the pad is placed, then click the right mouse button and the pad stays. You continue in that fashion until all pads are placed. On most layouts you really do not have to place too many pads since your symbols have the pads included.

Laying down tracks is a bit of a trick to get the hang off, but with some practice it is very easy. You select the new track command and click the left mouse button, then move the cursor to the new position, click again, and repeat the process for every straight line end point until you are finished with that track. Then click the right mouse button to complete the operation. The size and layer will be the default you used on the last operation. You can edit tracks to change size, layer, or position; or delete the whole track or just a segment of it

There is a snap-to-grid feature which can be turned on or off, and the grid can vary from 0.1- to 0.025-inch increments. Text can be placed anywhere on any layer, with variable size selection possible.

A status function allows the user to check the size of a track or pad on the layout. There are many block operations which allow you to copy, move, delete, rotate or get a mirror image of the area you draw a block around. You can also set some parameters so that you can be selective as to picking up tracks, text or pads only. The block command is used to get a copy of the layout to your dot matrix printer.

There is a file merge command which allows you to merge another layout into your current layout. This works well if you have a previous layout block, such as a regulator section, or any common layout you may use on many different circuit boards.

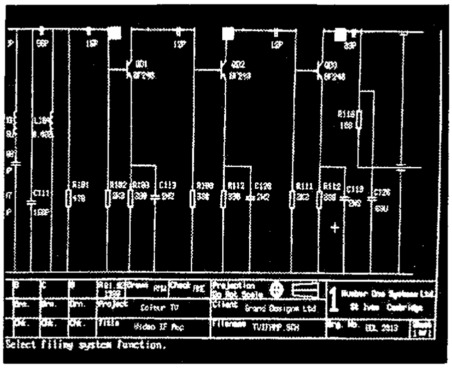


Photo C. Schematic diagrams can be drawn with Easy-PC with the built-in library of symbols.

The default colors are red and blue for track layers and white for the silk-screen layers. These colors can be changed if you want. Creating symbols is very easy. With the commands available, any geometric shape can be produced and the program even supports surface-mount technology. If you have a symbol on your layout or schematic that you have used many places and you discover you need to modify it, there is a function that allows you to change all occurrences of the symbol with one command. This is a very handy feature since everyone makes a mistake now and then.

Gerber Output

Easy PC's best feature in my opinion is the gerber output feature. This data can be plotted on a photo plotter which produces extremely accurate artwork with precise tolerance control. There are many photo plotter services available. In my location the prices are $16 dollars per layer and 24-hour turnaround time.

Another great feature is the drill file output. This file is sent to the board fabrication house, which uses the data to control a Numerical Control Drill Machine. This process allows complete automatic drilling of your circuit board, which again is another cost-saving feature.

You can also use your dot matrix printer to make layout drawings or artwork. The program supports most popular plotters.

Overall, I am very pleased with the performance of this program, especially considering the low cost. I have just received an update notice stating that the libraries have been significantly expanded to over 1,000 parts, and output to a laser printers has been added. For roughly $200, this program sure beats the old tape and mylar way of circuit board artwork. 73

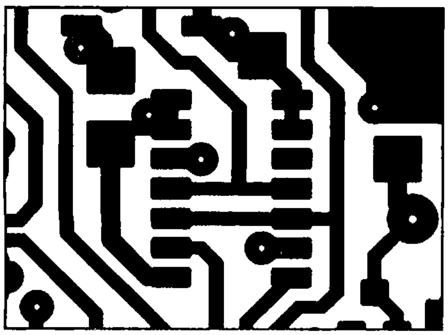


Figure. A laser printer output of one of the PC board layers.

Plumber's Delight

Continued from page 16

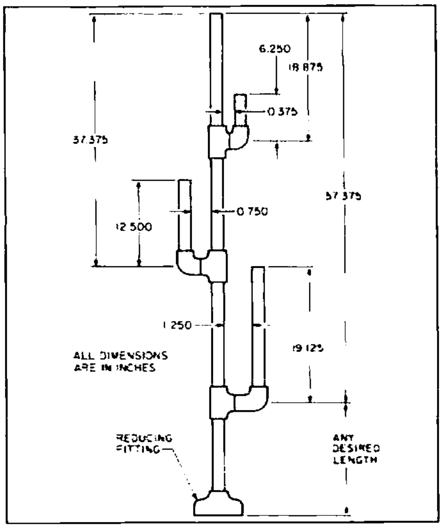


Figure 1. Tri-band J-pole antenna construction.

My finished antenna conformed very closely to the dimensions shown in Figure 1, and when I connected the feedlines I had 1.5:1 SWR or better on all three bands. The center frequencies chosen for this antenna are 146, 223, and 445 MHz. I had the antenna leaning up against a wood wall, and used a 12-foot scrap of coax to fine-tune the feedpoint. The stripped and tinned end of the cable was attached to each antenna section temporarily with Scotch tape.

I then transmitted into the antenna via a VHF/UHF SWR meter and moved the temporary connections up and down a little at a time until a 1.1:1 SWR was found. These points were marked on the pipe, and then small pilot holes were drilled. Small crimp-on eyelet terminals were first crimped, then soldered, onto the permanent feedlines.

Then I used self-tapping screws and lock-washers to attach the coax to the antenna. I cleaned everything up with a small brush and alcohol, to remove flux and dirt. Then non-corrosive RTV sealant was used to protect the connections against the weather. Non-corrosive RTV is that type which does not contain acetic acid. You can test for this by smelling of it; the proper type will NOT smell like vinegar. Route the feedlines from the two upper antennas down one side of the mast, 90 degrees from the plane of the stubs, in such a manner that the cables do not enter the space of the gaps below. You can use nylon zip ties to hold the cables in place.

I found that there was no change in SWR after I got the antenna away from the wood wall and up in the air with its permanent feedlines connected. SWR was 1.5:1 or better over the entire 2 meter and 1.25 meter bands, and over the entire 440 to 450 MHz section of the 70cm band.

No need to worry if you do not have access to a suitable SWR meter. Just connect your coax to the points indicated, and you'll have some very livable SWR values. On the other hand, if your finished antenna is not, physically, exactly the same as the measurements in Figure 1, you can use an SWR meter to adjust the feedpoints and still obtain close to 1.1:1 SWR. I found this out while helping my elmer (who is not a very good plumber) get his duplication of my model working. Formulas are provided in the table for those of you who would like to try this idea out on different center frequencies or bands.

Taking It Further

I built a version of this antenna for the 6, 2, and 1.25 meter bands out of 1.5" heavy duty steel TV antenna mast. It required two 10-foot sections of mast. The stubs were made from 3/4" galvanized pipe, and 1/5" angle iron was used to stand the stubs off from the mast. I used a MIG welder to put the thing together. Nylon guys were used.

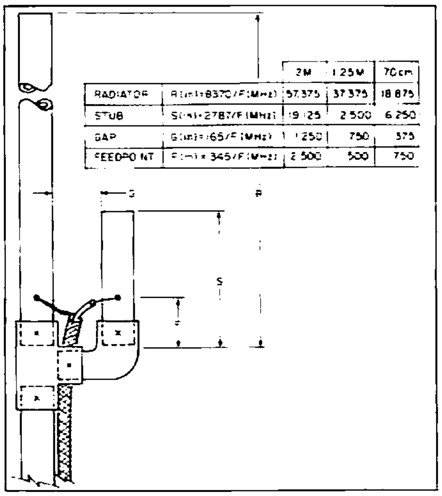
This worked very well. Then I bought one of those Create Designs log periodic antennas that covers 50 to 1300 MHz, and started to look for a place to put it. The only place I could figure was on top of that 6 meter J-pole. So I stuck it up there along with a cheap Radio Shack TV antenna rotor.

I mounted the rotor to the top of the J-pole and used only a 1-foot section of mast above the rotor to mount the log periodic. This really messed up my SWR for those three J-poles! But by moving the feedpoints up or down a little and testing the SWR, I was able to get all three of them back to 1.1:1 SWR again.

Now I had omnidirectional vertical gain antennas for three bands plus a horizontal directional gain antenna for six bands all on one mast! Hmmmm... maybe I'll get ambitious enough one day to take the beast back down and weld on a stub for 70cm. I wonder if that would work, too?

Yes, I'm J-pole loco, and you might catch the disease too if you start playing with them. This is the perfect thing for the new rank of Technicians just starting out, to get on the air with three bands and very little cash outlay. 73

Eric R. Johnson KB6EPO, P.O. Box 996, Imperial Beach CA 91933.



		2M	1.25M	70cm
RADIATOR	R(in)=8370/F(MHz)	57.375	37.375	18.875
STUB	S(in)=2787/F(MHz)	19.125	2.500	6.250
GAP	G(in)=165/F(MHz)	1.250	.750	.375
FEEDPOINT	F(in)=345/F(MHz)	2.500	.500	.750

Figure 2. Individual antenna element detail.

Number 12 on your Feedback card

ATV

Ham Television

Bill Brown WB8ELK
℅ 73 Magazine
Forest Road
Hancock NH 03449

The Flight of Eclipse 1

Every 20,000 years of so, residents of Southern California are presented with a dramatic sight: an annular eclipse of the sun just before sunset. An annular eclipse is a variation of a total solar eclipse which occurs when the diameter of the moon doesn't completely cover the solar disk. The end result is a spectacular ring of fire surrounding a dark center.

The eclipse would happen on January 4 just a couple of minutes before sunset and would be viewable along the Southern California coastline. Since the weather during January has about a 50-50 chance of being favorable, Mike Henkoski KC6CCC, Mike Collis WA6SVT and I decided to stack the odds in our favor and attempt to watch the eclipse from the stratosphere (above the clouds) with an ATV balloon.

Marathon Payload Building

We all assembled at Mike Henkoski's QTH the night before the eclipse with a large pile of parts and began a 24-hour marathon session of payload construction. We televised hourly updates via the WA6SVT ATV repeater on Santiago Peak, showing each phase of the assembly process.

Just one hour before the eclipse, we finally had transformed a pile of miscellaneous parts into a mini-spacecraft. We also succeeded in transforming KC6CCC's formerly pristine shack into an absolute junkyard! Our final configuration consisted of a Microtek micro-TV transmitter (see the July '91 issue of *73*, page 9), the companion subcarrier sound board, a PC Electronics PA-5 power amplifier, a Micro Video Products miniature B/W TV camera, a video ID board, an ICOM 2A HT, a 30 milliwatt 10 meter AM transmitter, and a voice IDer (see the November '91 issue of *73*).

The ATV antenna system was somewhat unique. Mike WA6SVT transformed a radar reflector into a quarter-wave vertical which would be suspended eight feet below the package during the flight. In addition, the shield of the ATV coax worked as half of the 10 meter dipole.

In order to keep the package pointed at the sun, Mike KC6CCC designed a solar tracking system out of a pair of photo cells and a radio control servo. This servo controlled a large fin made out of a paper file holder. Whenever the package moved away from the sun, the fin would act as a rudder and try to steer the package back towards the sun. This system worked fairly well, but the movement of the fin was uneven and didn't lock onto the sun continuously.

In order to pan the camera view, we used an idea used by Joe Mayenschein WB9SBD. In an earlier flight, Joe mounted a mirror in front of his TV camera and rotated the mirror with a small motor.

Liftoff

A large crowd assembled near the beach at a park in San Clemente as we inflated the balloon. They even stopped a nearby soccer game so the participants could watch the activities. Just 35 minutes before the eclipse, we finally had everything buttoned up and ready to go (final testing occurred on the park's picnic table!). There was absolutely no wind, so we could just reel out the balloon string and gently let go of the payload. If only all our launches were this easy! We brought along a portable TV so the spectators could see the fantastic views of the California shoreline which was transmitted down from the on-board TV camera. Gordon West WB6NOA also brought along his ATV receive station which generated a large viewing audience.

Airborne Repeater

Since we were flying with a 2 meter HT on board, we used it to listen on 146.43 MHz and retransmit the audio out on the video subcarrier as well as the 10 meter transmitter (an AM modulated computer clock oscillator on 28.322 MHz). In essence, we had an airborne dual-output crossband repeater. Every 30 seconds the voice ID/timer circuit would key up the 2 meter transmitter for a short message to aid in tracking.

Activity was brisk through the crossband repeater as stations farther and farther away could be heard through the balloon repeater as it gained altitude. The 30 milliwatt mini-AM transmitter was heard as far away as South Dakota (Paul WQ0M) and Wisconsin (Joe WB9SBD). We even had a fellow at the launch site listening in on his shortwave receiver.

Quite a View

The view from the balloon's TV camera was spectacular. The rotating mirror (two minutes for a complete revolution) gave us a continuous coverage of both horizons, the ground below, as well as the balloon straight overhead.

We gathered in KC6CCC's back yard to view the actual eclipse at sunset. John Hoot N6NHP (of Software Systems Consulting) had a telescope set up with a video camera to tape the event. Although we did see the full eclipse for a very brief time (see Photo A), it was partially covered by clouds. The Los Angeles area didn't even have a chance due to a solid overcast just to our north.

After sunset, we rushed inside to see how the balloon's TV camera was doing with the eclipse. Even though it was rapidly getting pitch dark on the ground, the balloon camera could still see the sun. At 40,000 feet, sunset would not occur for another 20 minutes! We should've used a solar filter in front of the TV camera, as the brightness of the sun was overloading the camera even during the maximum eclipse. It was still quite fascinating to see a sunset from the stratosphere!

The 6-watt ATV transmitter worked quite well. Snow-free reception of the signal was reported from most of Southern and Central California. Pat W6YEP in Fresno reported P-5 results for most of the flight (280 miles). Norm WV7K and members of the AAA5 club in Phoenix, Arizona (300 miles), had nearly P-5 reception (the IDer was in full color) with perfect subcarrier sound for over an hour.

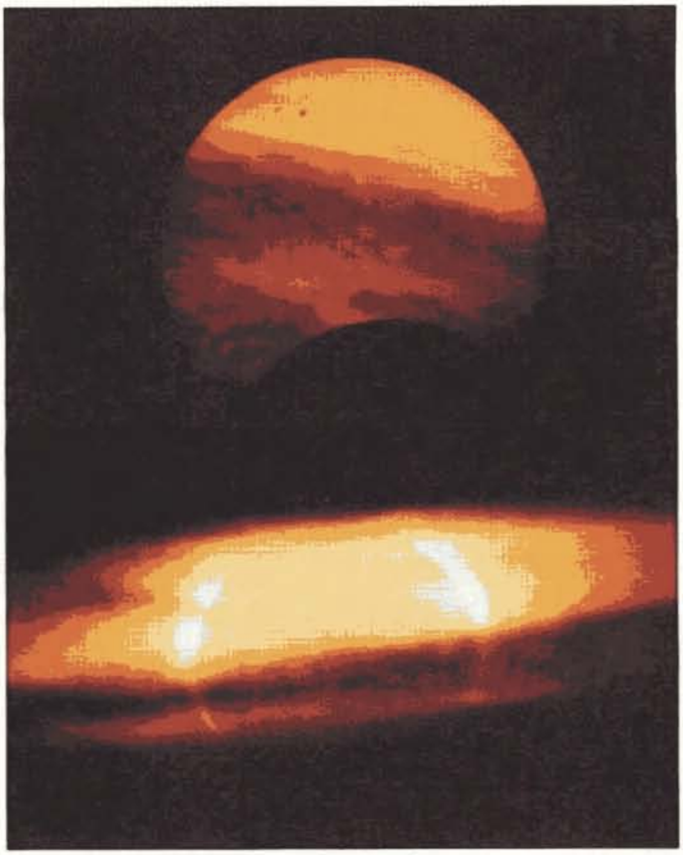


Photo A. A rare and spectacular annular solar eclipse at sunset as seen from Mike KC6CCC's yard in San Clemente, California. (Photo by John Hoot N6NHP.)

The crossband repeater worked well for the first 30 minutes of the flight, however the cold temperatures caused the timer board to malfunction resulting in a continuous loop of the voice ID. I'm sure the Southwest is a little tired of my voice by now, but it did help the T-hunters track down the payload since the 2 meter transmitter was on continuously.

The Chase

Before the flight, I contacted Scott Bovitz N6MI and Joe Moell K0OV of the Southern California T-hunt group. If anybody could track down and recover the payload, it would be this group. No matter what the circumstances, I knew they would find a way to locate the landing site of the package.

The computer prediction showed that the payload would land about 50 miles to the east-northeast. This was an area of rugged mountains with very few passable roads. To top it off, the balloon would be landing at night! A definite challenge to the T-hunters. As the balloon came down, the T-hunters had its location pegged right down to the point of touchdown. With Kuby N6JSX coordinating the mobile trackers via a repeater, they quickly converged near the top of Little Thomas Mountain (about 5,000 feet high) and re-acquired the signal in short order. Unfortunately, they couldn't get much closer than a mile

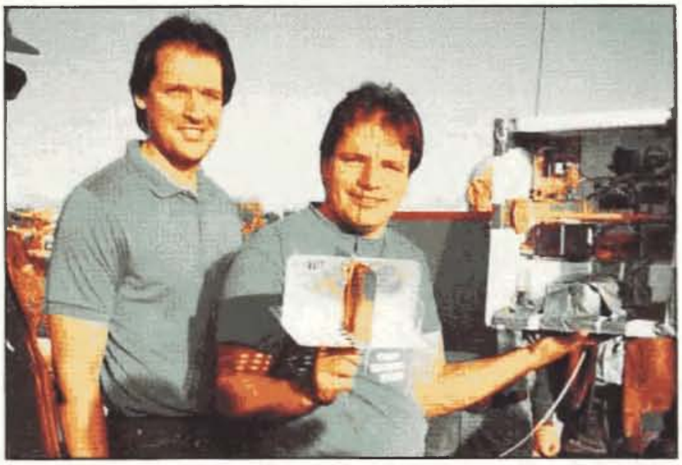


Photo B. (l to r): Mike Henkoski KC6CCC and Mike Collis WA6SVT (holding the combination radar reflector/ATV antenna) make the final tests on the balloon package.

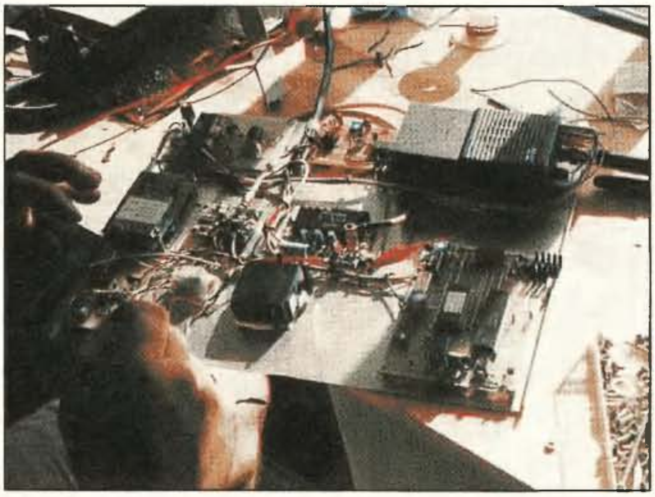


Photo C. All of the electronics were mounted on an aluminum sheet to dissipate the heat from the 6-watt ATV power amplifier.


Photo E. The balloon takes off just 35 minutes before the solar eclipse.

or two on any of the roads (a lot of vehicles got stuck getting to this point).

Imagine crashing through dense Manzanita brush in the middle of the night on a freezing cold mountain while trying to track down a hidden transmitter. After the storm hit in the wee hours of the morning, they had to give up the hunt until the weather improved. It was a challenge just to find their way back to their vehicles!

Although the ATV portion of the payload died out after five hours, the 2 meter HT and the 10 meter transmitter were on a different battery system that would last several days. Fortunately, it was still transmitting two days later (the first good day after a large storm pelted the area). As the T-hunters closed in, the signal suddenly appeared to be moving. Apparently the balloon package had grown legs and was walking out on its own! A local resident had found the payload and carried it back to his cabin. The T-hunters tracked him down and rescued the package.

Back in One Piece

Even after sitting out in the snow and rain for over two days, the payload was in perfect shape. The film from the on-board 35mm film camera was rushed to the developers. The camera had taken only three pictures, however. One good sunset shot at 2,000 feet, and a couple of cloud pictures at 12,000 and 22,000 feet. It apparently froze up after that. Not much solar radiation to keep it warm during an eclipse.

This was a fun flight that hopefully stirred up activity across the Southwest. I know at least one (possibly more) of the spectators at the launch site may be joining the ranks of hamdom as a result of watching the ATV receive station at the park.

I can't say enough about the sheer determination of the Los Angeles T-hunters. Without their incredible efforts, the package may never have been found. Look at this month's "Homing In" column by Joe Moell KØOV for an excellent account of the balloon recovery effort. 73


Photo D. (l to r): Bill WB8ELK and Greg DeWit WA6JAD get ready to launch the balloon.

73 Review

by Louis A. Smith II N3BAH

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Fax: (317) 849-8794
Price Class: $1095

The AOR AR3000 Communications Receiver

Continuous coverage from 100 kHz to 2036 MHz in a three-pound package.

Few receivers offer good coverage on both shortwave and public safety bands, and those that do are high priced and include sophisticated features not needed by the average hobbyist. With today's soaring costs, economy of equipment is important, particularly for the operator on a limited budget. That's why the introduction of the AR3000 communications receiver is a welcome addition to the amateur and radio hobbyist market.

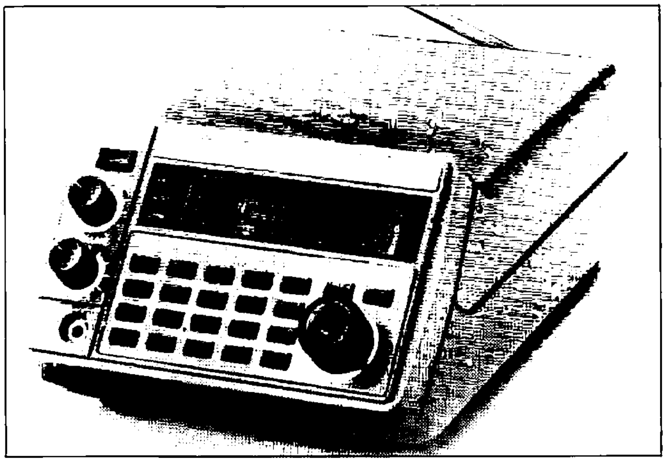


Photo A. The AOR AR-3000 communications receiver.

The AR3000 is a combination general coverage and scanning monitor receiver, with synthesized coverage extending continuously from 100 kHz to 2.036 GHz, 400 programmable memory channels, and four independent search ranges. It's a vastly improved version of earlier AOR models, and is tailored to the needs of the radio amateur by providing more essential features, without unnecessary frills. Modes received include AM, USB, LSB, CW, and narrow and wideband FM. Programming is accomplished via a front panel keyboard augmented by a rotary dial, or by an optional PC control capability. All information regarding programming and frequency storage is displayed on the easy-to-read LCD display which also contains a bar-type LCD S/RF meter. The control complement is rounded out by rotary volume and squelch and an on/off push-button. On the rear panel are the BNC antenna and power connectors, a 3.5mm external speaker jack, and a 9-pin DIN jack for use in automatic tape recording.

The AR3000 is a professional-looking, compact receiver. Housed in a 3-1/7" (H) x 5-2/5" (W) x 7-7/8" (D) dark gray plastic case with a sloping front panel, the unit weighs less than three pounds, yet is solidly constructed and ergonomically pleasing. Accessories included are an AC adapter, DC power cord with cigarette lighter plug for mobile use, 26-1/2" telescoping antenna with BNC connector, instruction manual, and one-year manufacturer's warranty. Optional accessories available from AOR include an earphone, mobile mounting external speaker, mobile mounting bracket, wideband preamp, and an extended warranty program.

Front Panel Controls and the PC Option

All receiver functions are controlled by the front panel keyboard, which consists of 26 individual keys, 22 of which perform dual functions such as mode and increment selection. In order to activate the alternate functions labeled above these numeric keys, you must first press the second function key, followed immediately by the key with the desired alternate function. In contrast with those used on early AOR models, the keypad used on the 3000 is sturdily built, with keys that do not wobble in their slots, and a label template surrounding them which is firmly adhered to the case. The only negative comment regarding the control ensemble is that the dark color used to indicate the keyboard's second functions makes the template difficult to read in low-light conditions.

In addition to using the keyboard for direct frequency entry, the professionally-styled tuning knob adds a familiar touch to this computerized receiver for those who are accustomed to using slide-rule tuning. It is designed so that the synthesizer will move one increment/channel up or down for each click of the knob when in the manual mode. *[Ed Note: The new AR3000A model has a smooth feel tuning control.]* The adjacent directional arrow keys operate in a similar manner, and may be used to fast forward/reverse when held down.

The front panel volume and squelch rotary controls operate smoothly throughout their range, and the push-button on/off control allows you to return to a preset volume setting instantly. A front-mounted 3.5mm headphone jack allows for private listening.

Directly above the keys is an LCD display, providing a constant readout on all receiver functions. Data included in the display's readout includes the frequency received; whether the unit is in the manual tuning, manual searching, or automatic (programmed) searching status; the channel number when scanning one of the memory banks; plus a bar-type signal strength meter. A 24-hour format digital clock is also included, which remains visible even when the radio is not in use. All information is easy to see against the display's green background, and an adequate backlight is also included to enhance low-light viewing. To the left of the LCD display are LED indicators which show which scan/search bank the unit is operating in, as well as indicating engagement of the sleep timer feature, and when the keypad is in second function key status.

In addition to the keypad, the AR3000 may also be directly controlled by a personal computer. On the rear panel of the unit is a bus connector for interfacing with any PC with an RS-232 serial port. Optional cable and software needed to interface with an IBM or

MS-DOS type machine may be purchased as accessories. PC control also greatly expands frequency storage capability. Detailed interface instructions are provided in the instruction manual, and while I was unable to personally verify this aspect of the unit's operation, reports from other sources indicate few problems using PC control. Of course, ACE offers complete technical assistance via their toll-free information and order line.

Programming and Searching

As received from the factory, the unit contains no pre-programmed frequencies and must be loaded with the user's selections. Programming is easy, and you may want to either directly enter your favorite channels or use one of several search features to discover new ones.

Representing a true hybrid between a conventional scanning monitor and a general coverage receiver, the AR3000 allows you to select frequencies in several ways. First, direct keyboard entry of any frequency may be accomplished simply by first touching the "Dial" key, and then entering the desired frequency on the keypad. Next, you press the "Mode" key and turn the tuning knob to select between AM, CW, NFM, etc. modes as indicated in the display, and then press "Enter." Finally, you select a tuning increment, which can be any number down to 50 Hz. With these initial settings completed, each click of the tuning knob or press of the arrow keys will adjust the frequency upward or downward by one increment. To activate automatic tuning (which the instructions call "manual searching"), you hold down the appropriate directional arrow key for several seconds to start the receiver automatically advancing in the selected direction until it encounters an active frequency. Manual searching may be resumed again by using an arrow key or the tuning knob. To return to manual tuning, simply press the "Dial" key again. A separate "Dial" frequency and related data may be stored in each of the four memory banks.

The second means of locating active frequencies is automatic (or "programmed") searching. After selecting one of these banks, labeled M1 through M4, pressing of the "Search.Set" key in its second function begins prompting you to enter the intended search increment, reception mode, and the lower and upper search limits. The internal microprocessor takes over and begins moving from one search range to the other at a rate of approximately 20 increments per second. Separate automatic search ranges may be entered into each of the four memory banks, and searching must be conducted in only one bank at a time, since banks cannot be linked together. The search direction can be changed instantly by a turn of the tuning knob.

An interesting function of the tuning knob in relation to searching is that by pulling the knob out slightly, the search increment is multiplied by a factor of 10, so as to move through the range more quickly. When this feature is engaged, the word "step" appears in the display, and disappears when stepping is disengaged by pulling the knob once more.

Finally, frequencies may be loaded into the memory channels. To accomplish this, you select one of the memory banks using the second function "Bank" key to toggle among the four banks of 100 channels. Frequencies can be entered into individual channels numbered 00 through 99 within the bank, using a similar keyboard sequence as for direct keyboard entry described above. Frequencies may be entered in any combination of bands and modes, keeping in mind that channel 00 is designated as the priority channel in each bank. Active frequencies encountered when manually or automatically searching may also be directly entered into a memory bank channel.

"The unit's frequency coverage is unsurpassed by any other commercially available synthesized scanning receiver in its price class."

Each bank may be automatically scanned, or used as a bank of preset channels to manually select from. This is especially useful when monitoring shortwave broadcasts or checking your favorite net and repeater frequencies. In addition, individual memory channels may be locked-out by pressing the second function "Ch.Pass" key to engage the Channel Pass feature when stopped on the desired channel.

Once entered, all search ranges, memory channels, and related data are permanently stored in a non-volatile memory, and may be reviewed or changed at the user's discretion.

Performance

The AR3000 performed outstandingly well in all areas of its specifications, demonstrating excellent sensitivity and selectivity across the spectrum. Even in UHF and higher frequency bands, the ability to receive signals far greater than the usual "line of sight" distance was good even when using the telescoping whip antenna. This, coupled with the fact that very few birdie frequencies were encountered (e.g., only one was noted between 220–225 MHz), made monitoring a breeze. No adjacent channel interference was noted, and the 2-1/2" internal speaker's output was more than ample, though the fact that it was bottom-mounted tended to direct the sound into the surface on which it was sitting.

The unit's scan/search speed of 20 channels per second was adequate to cover a full bank of 100 channels. If using a memory bank to scan public safety frequencies, which often have spontaneous, short transmissions, it is advisable to only scan over about 40 channels, to lessen the likelihood of missed transmissions. If scanning a group of amateur repeater/simplex channels, a full 100 channel repertoire could be effectively scanned, as the transmissions would be sufficiently long to stop the scanning, and allow you to manually select a conversation of interest. To preclude the possibility of missed transmissions when scanning an entire bank, however, a scan rate of at least 40 channels per second would be more desirable.

One observation relating to the scan feature is that when frequencies from diverse parts of the spectrum are grouped in a single memory bank and scanned, the unit tends to skip over active channels unless there is a very strong signal present. A good example of this is when one attempts to group frequencies from the HF amateur bands with those in the VHF range into the same bank. The unit was observed to skip over signals whose presence was only noted by momentary flashes on the signal strength meter. A similar situation also occurred when frequencies from both FM and non-FM modes were grouped into the same bank. While ACE's instruction manual does not address this condition, the best advice is to keep channels utilizing the FM mode in a separate bank from those channels utilizing USB, AM, etc.

Most monitoring on the VHF bands and above involves FM reception. Due to its wide frequency coverage, the AR3000 includes a dual FM reception capability with narrow (NFM) and wide (WFM) modes available on any frequency. In the NFM mode the unit receives the standard 5 kHz deviation FM voice modulation common in the VHF/UHF amateur, land mobile, and cellular radio services. WFM is provided for reception of standard FM broadcast signals between 88 and 108 MHz, and the audio portion of TV broadcast signals in the VHF and UHF spectrum. Some users of the AR3000 report success in using the WFM mode in conjunction with equipment to demodulate weather and other satellite signals around 136 MHz. *[Ed Note: I've used the AR3000 to successfully track weather bureau radiosonde balloons on 1.680 GHz (wideband FM).]*

Special Features

Enhancing the unit's searching versatility are several unique features known as Frequency Pass and Free Scan, which allow for virtually hands-free operation.

Frequency Pass is a blessing for anyone who has ever used a receiver with a synthesized search feature, only to find an annoying "birdie" frequency in the midst of the search range. In such cases, even in the absence of actual signals, the internally generated birdie would halt searching, requiring operator action to resume the search. The AR3000, despite its relatively small number of birdie frequencies, compensates for this problem by allowing the user to enter up to 48 of these problem frequencies into a special memory. The user accomplishes this by touching "Freq.Pass" in the second function mode, and then entering the problem frequency. The radio permanently remembers these entries, and will eliminate them anytime the radio automatically searches over a range containing them. It will not prevent such frequencies from being monitored in either the direct keyboard entry or manual search mode. Passed frequencies can be easily displayed for verification, and deleted at will using a few simple

keystrokes. This feature is useful not only for blocking out interference signals, but also when trying to locate new frequencies in a part of the spectrum populated by numerous active frequencies. In the latter case, these known active frequencies can simply be "passed," thus leaving the receiver to stop only on previously unknown active frequencies.

Another unique feature is Free Scan, which can be used either when searching or scanning in a memory bank. Free Scan causes the receiver to resume automatic searching approximately five seconds after an active frequency is located, even if the signal is still present. In this way, when searching in a band with numerous active frequencies (for example, shortwave broadcasters), the listener can briefly sample each active station without ever having to touch the receiver. This feature can also be used when scanning the channel banks. When using Free Scan, the decimal points in the LCD multi-function display alternately flash between the MHz and kHz positions.

An interesting feature which is useful for monitoring repeater traffic is Frequency Shift. After programming in the desired repeater offset (for example, +5.0 MHz for 440 MHz FM, or ±0.600 MHz for 2 meters), you may instantly monitor the signal on the repeater input by pressing "Freq.Shift," in much the same way as on synthesized transceivers.

Wrapping up the list of features is a programmable sleep timer, which allows you to set a length of time after which the radio will automatically shut itself off. The "Alarm" feature allows you to enter a desired "on" time, so that you can wake to the same frequency, search or scan bank which the radio was operating on when it was last turned off.

A voice-activated auto tape-recording capability is also provided via the DIN jack on the rear panel. General details on interfacing with a recorder are supplied in the instruction manual. This feature allows you to capture all transmissions on a cassette tape for review later.

While the unit resembles a conventional programmable scanner, hiding behind this disguise is an outstanding shortwave receiver. Expanded frequency coverage allows reception of international broadcasts in all bands below 30 MHz, with more than adequate sensitivity to receive a full spectrum of stations using the telescoping antenna, due to the GaAsFET RF amp employed. While the unit lacks several other features useful on shortwave, such as an AGC control, noise blanker, or notch filter, this does not impair the unit's functioning on these bands.

HF performance is enhanced from earlier models by the addition of a user-adjustable tuning increment. With a minimum setting of 50 Hz, tuning in the amateur and shortwave broadcast bands demonstrated that the AR3000 is a serious contender among communications receivers. It is easy to ferret out one signal from the pack with a receiver capable of such sharp tuning, due to the 15 band-pass filters the AR3000 uses to sharpen tuning. I experienced little difficulty in separating signals, even in a pile-up. In summarizing the HF tuning characteristics, I found the combination of the user-adjustable tuning increment and the frequency step feature (which allows you to multiply the increment by a factor of 10 simply with a pull of the tuning knob) worked together to make the AR3000 a pleasure for listening to either sideband, CW, or AM shortwave broadcasters.

One welcome result from the combination of shortwave and scanning receiver in the same package is the ability to search for active HF frequencies and then store them in the scan banks for future reference. With over 400 memory channels, the unit provides ample room for all the international broadcast and other frequencies of interest, while still allowing space for conventional VHF/UHF FM scanning. A similar use may be made of the unit's coverage in the VHF/UHF television bands using the WFM mode. For example, after locating the pertinent audio segments for the TV channels in your area, you may program them into a memory bank, allowing for easy listening to TV audio when you're traveling!

The unit's ability to switch from a fixed memory channel to the "Dial" status also complemented its coverage of the amateur bands. By simply touching the "Memo.Bank" key while scanning a memory bank, you may take frequencies from the memory channels and tune around using this channel's frequency as a starting point. I made use of this feature to keep track of active net frequencies, and to tune above or below them to catch off-frequency stations. Varying the frequency in this manner does not alter the memory channel contents.

Also accessible from the keyboard is a 10 dB signal attenuator, which will lessen the input signal level. While the unit handled strong signals without distortion in the regular mode, the attenuator could prove useful for VHF/UHF monitoring in urban areas where the spectrum is congested.

Performance on the VHF/UHF bands was also impressive. The unit's frequency coverage is unsurpassed by any other commercially available synthesized scanning receiver in its price class. It is important to note that, unlike some competing models, the AR3000 provides full spectrum coverage between 100 kHz and 2036 MHz with no portions locked out or eliminated. The excellent sensitivity and selectivity exhibited on VHF/UHF were virtually unequaled for monitoring narrowband FM transmissions (i.e., no noticeable difference in sensitivity was apparent in receiving frequencies as diverse as 146 MHz and 800 MHz). The capability to receive all amateur frequencies, most of which are traditionally eliminated from scanners, as well as UHF aircraft between 300–400 MHz and cellular land mobile at 800–900 MHz, provides an extra bonus. Once you become accustomed to the keyboard repertoire, entering frequencies for the police, fire, amateur, and other services occupying these bands becomes second nature. While brief, the instruction manual provides all necessary information on programming and after practicing entering search and memory information a few times, it's easy to catch on.

The large number of memory channels allows emergency service and amateur frequencies for specific geographic areas to be entered in their own bank, making it easy to change from one frequency group to another at the touch of a button. This feature is especially useful when using the AR3000 in a vehicle, since it allows you to switch to a completely programmed bank for each area through which you are traveling.

The receiver's true versatility is evident in its ability to instantly switch from scanning the banks to functioning as a tunable receiver at the touch of the "Dial" key. For example, you can switch from scanning for local police transmissions to checking your watch against a WWV time signal, all in a matter of seconds! Such changes require a minimum of keystrokes, since the frequencies or search ranges and corresponding modes can be programmed once into the unit's memory, and can then be instantly recalled anytime. The combined HF through 2 GHz capability in a single unit no larger than a conventional scanner is truly welcomed, and should serve to introduce many police/fire/EMS buffs to the intrigue of the world below 30 MHz, as well as to acquaint denizens of the amateur bands with the multitude of other radio services occupying the spectrum.

With great frequency coverage and a minimum of inconveniences, the AR3000 is a pleasure to use. It's user friendly and delivers good performance in all frequency ranges. The wide frequency coverage and multiple modes make it a great all-purpose receiver for the radio amateur, shortwave or VHF/UHF listener, and its low price tag makes it a worthwhile investment. 73

AR3000 Specifications

Frequency Coverage	100 kHz–2036 MHz	
Sensitivity	0.35 μV NFM	
	1.0 μV WFM/AM/SSB/CW	
Selectivity	Not furnished	
Scan/Search Speed	Approx. 20 channels/sec.	
IF Frequencies	1st	736.23 MHz
	2nd	352.23 MHz
	3rd	198.63 MHz
	4th	45.0275 MHz
	5th	455 kHz
Audio Output	1.2W at 4Ω	
Power Required	13.8 VDC at 500 mA	

Number 16 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
P.O. Box 131646
Staten Island NY 10313-0006

Radios and Runners

"Why am I doing this?" I sleepily asked myself as I drove to Fort Wadsworth, Staten Island, at 4:30 a.m. on November 3, 1991—Marathon Day in New York City. Every year that I've participated in the Marathon, I've had this diatribe with myself. I'm not even a runner! I go there as a dutiful ham and because my friend and ARRL Director Steve Mendelsohn WA2DHF would yell at me if I didn't.

Photo A. 25,000 runners arrive at the crack of dawn at the starting line at the Verrazano Narrows Bridge.

Photo B. (Left to right): Gus Hahn KA2STS, Rich Baias N2KOO, George Rice Jr. NA2V, and Stan Olochwoszcz N2AYJ at Radio Headquarters at Fort Wadsworth, Staten Island, New York.

With eyelids at half-mast, I approached the fort at the foot of the Verrazano Narrows Bridge where the Marathon begins. Within minutes of arriving at the command headquarters for the amateur radio operations, I was totally caught up in the spirit and the excitement of a most incredible event. (A strong cup of coffee didn't hurt, either!) There obviously has to be a good reason why 8,000 volunteers participate in helping to support the 25,000 runners who begin to show up at the crack of dawn.

Marathon Vita

The "numbers" associated with the New York City Marathon are impressive. Nearly 3,000 New York City police officers work along the Marathon route. To date, a total of 221,898 runners have crossed the finish line of the 21 previous Marathons. Citizens of 124 countries have participated in the Marathon's first 21 years. (In contrast, just 111 countries have been represented at the 12 Olympic Games dating back to the inaugural of the Modern Games in Athens in 1896.)

The New York City Marathon is the largest Marathon in the world, with over 45,000 applications submitted. And, according to the NYC Police Department, it is the largest spectator sporting event in the world. Nearly 2 million people line the streets at various times during the race. In 1991, there were 8,000 runners from 91 countries. Over 350 linguists were recruited from United Nations volunteers and from Metro International, a group of exchange students.

Over 200 American Red Cross volunteers assisted the city's Emergency Medical Services team. Besides providing non-emergency first aid treatment, they also distributed and served 32,000 cups of coffee, 12,000 cups of hot chocolate, 6,000 cups of tea, 5,6000 sandwiches, 15,600 donuts and 8,400 rolls. Can you begin to picture the amount of work, organization and effort that goes into this event?

Who Makes It Work

The contributions of all the volunteers are vital to the smooth operations of this mammoth enterprise. Obviously, though, it is the communications aspect which is at the core of the organized efforts of the entire event that day. More than 400 ham radio volunteers representing seven states set up a network of communications that has been called the "Central Nervous System" of the Marathon.

Nets are set up to deal with the problem of downed runners, calls for doctors and medical supplies, and for the replacement of other supplies and equipment needed that day. Ham radio operators are the link to the concerned people waiting at the Family Reunion Area to inform them if their friends or family may have dropped out, and where they can meet.

In the past, I've been assigned to the supply truck at Fort Wadsworth, and to "shadow" various administrators and coordinators and offer communications capabilities wherever they are needed. This year I was assigned to "shadow" the doctor in charge of the medical area, Joe Wisenfeld. The NYC Marathon has the largest medical staff ever assembled for a sporting event. The staff includes 1,500 doctors, podiatrists, chiropractors, nurses, physical and massage therapists, emergency medical technicians, and support medical personnel. I was really impressed with the dedication and professional care I saw being administered in the medical tent.

Several former ham radio students of mine who were runners that day followed the orange hats until they found me. As a ham, I feel good being part of a team that is so vital to the safety and success of the participants. It's also gratifying when folks who know you stop by to say "thanks," and when strangers take the time to tell you how much they rely on seeing those orange Amateur Radio Emergency Communications caps along the route.

Hams on the Sweep Bus

My friends Bob Chamberlain W2HVX and Richard Sandell WK6R were doing their part on the Sweep Bus. Bob told me that he thinks that nowhere is the contribution of amateur radio communications to public welfare and safety more evident than in the Sweep Bus Operations of the NYC Marathon. This year eight buses were used on the route to pick up runners who had dropped out of the race and to transport them to the Family Reunion Area in Central Park. Every bus has a ham radio operator on board with the ability to communicate the location and condition of boarding runners, and to call for quick medical assistance if needed.

Information was immediately relayed by the hams to family members in the Central Park facility as to whether their runner had boarded the bus, whether or not there appeared to be any injury, and the expected bus arrival time. Further information was made available on the whereabouts of runners transferred by ambulance to a hospital.

Bob tells me that some runners who boarded the bus were too sick to get off by themselves. Hams were instrumental both on the buses and off in calling for ambulances or other medical assistance to help these runners. Also, if a runner fell between the mile markers, he was likely to be helped by the hams in pre-positioned buses along the route or by a ham on a Sweep Bus. The ham radio operators were in a position to observe the problems immediately and to quickly offer assistance via their radios.

The volunteer ham radio operators use their own portable radio equipment to communicate from inside their buses over the entire Marathon course from the starting point on Staten Island through all the boroughs of New York to the finish line in Central Park, a distance of 26.2 miles. Members of the Amateur Radio Emergency Service join forces with operators from the ARRL in helping to smooth the way in every aspect of Marathon operations.

The group is organized by Steve Mendelsohn WA2DHF. A responsibility of this magnitude could only be handled by a thoroughly dedicated and talented individual who knows how to motivate and to get the best out of the hundreds of hams who volunteered. Steve works with the radio clubs throughout the year, helping to get things organized lor the big event.

On Staten Island, two hard-working hams, George Rice NA2V and Steve Zuvicich KA2HXU, were coordinators of the starting area communications. It's a pleasure working with these people every year. From the time the hams start their operations at Fort Wadsworth on Saturday at 11:30 p.m. to Sunday's final transmission at 7:00 p.m., they are on the air, helping keep participants and the viewing public safe.

Back in my class the next day, I was exhausted, but armed with countless ham radio stories to share with the children who love to hear these anecdotes.

So I guess I'll be griping again next year when my alarm clock rudely awakens me on Marathon morning. But I also know I'll keep on going back because I'm so very proud to be a part of the amateur radio team.

Number 17 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
P.O. Box 2508
Fullerton CA 92633

Foxhunt Fame Awaits You

The gauntlet is down! If you think of yourself as a worldclass foxhunter, here's your chance to prove it. You're hereby invited to be part of one of the world's most prestigious radio direction finding (RDF) competitions.

More on that in a moment, but first some background for new readers. Hidden transmitter hunts, often called foxhunts or T-hunts, are an exciting ham radio sport. Hunters compete using various types of RDF gear, trying to locate one or more "fox" stations.

Here in the USA, most hunts involve mobiles and lots of driving. Almost everywhere else in the world it's an on-foot sporting event (see Photo A). For an in-depth look at international foxhunting, see "Homing In" for September and December 1991, plus "Showdown in Portland" in the November 1991 issue of *73 Amateur Radio Today*.

The Lvov Connection

Your invitation to foxhunt fame and glory is being passed along via John Douglas NØISL/UA4LIS, Technical Director of the Foundation for Amateur International Services. John is not a T-hunter himself. He is an ardent US DXer who has made many friends in UA-land over the years. These friendships led to an invitation to visit.

Last year, NØISL and David Larsen KK4WW went to Lvov (pronounced "luh-VOHV"), Ukraine, and Ulyanovsk, Russia, to give seminars on industrial automation. Their host, Victor Goncharsky UB5WE, arranged meetings with local hams at every stop along the way.

"We flew into Moscow and took the train to Lvov, which takes 25 hours," John explains. "During the train trip, I was introduced to Igor Shewchuk UB5SBD. He's 'Mr. Foxhunter' in the Ukraine, and runs all of the local competitions. He asked me if I would like to come out and see a hunt and maybe chase down a fox.

"That was just too good an experience to pass up. Lvov has the second largest foxhunt in the Commonwealth each year, second only to the Moscow Games. The sport is closely regulated by the Radiosports Federation.

"I got to see a training competition. They have a young persons' event for ages 15 through 19. Boys and girls are in different classes (Photo B). They also have events for adult teams and adult individuals.

"A standard foxhunt course consists of five transmitters, each beeping for one minute in sequence, on one frequency (see Photo C). A finish line transmitter operates continuously on a separate frequency. Your mission is to find all foxes in the shortest time."

"The events are stretched over two days," John says, "so you may have two hunts one day and one the next, for example."

You should be in good physical condition if you want to compete. UB5SBD writes, "Foreign foxhunters need to consider their ability to run or walk up to 10 kilometers in two hours." Of course, if your RDF skills are less than perfect, you may cover much more than 10 km!

Visiting teams from faraway countries always add excitement to a radiosports competition. The Ukrainian Open RDF Contest has hosted teams from Finland, Japan, Russia, and Czechoslovakia. Participation by a team from the USA would be a first.

Photo B. Boys, girls, men, and women compete in various categories, trying to find the five fox transmitters. This Russian hunt is on the 80 meter band. There are also 2 meter events, and sometimes 10 meters is used.

Photo A. Foxhunting won't make you rich, but there are lots of medals to be won and good times to be shared at international competitions. Winners of the Ukranian hunt can compete in the IARU Regional Championships.

"Igor would just love to have an American team compete," says NØISL. "He asked me if I could find anyone who was interested in attending the Games this year in September. He is willing to help with the invitations, picking people up in Moscow, bringing them into Lvov, loaning them equipment, and letting them practice in advance."

Tempus Fugit

I'll tell you more in future columns about Lvov, its hams, and radiosporting in the Ukraine. Meanwhile, start your training program, get your passport, and check your piggy bank. Even though athletes are given priority, it takes time for the Ukrainians to authorize your visit and to arrange for your ham privileges there.

Igor and his ham friends will host you in Lvov, but you must be responsible for your transportation to that city. Expect to spend about $1,200 per person. John has promised to help with arrangements.

NØISL is a seasoned traveler to that part of the world and can give you practical advice on what to bring, what not to bring, and what to expect. For example, you need not bring your RDF gear—there will be plenty for you to use. But be sure to pack practical items such as AA batteries to exchange as gifts.

If you are truly serious about taking part in the Ukrainian Games, write to John at 19164 - 147th Street NW, Elk River MN 55330. John is active on Internet; his address there is jrd@duke.cdc.com.

"Homing In" will be closely following the organizing of RDF Team USA. Please let me know your plans. Write to me at the address above (SASE please if you want a reply) or contact me electronically via CompuServe (75236, 2165), Internet (JoeMoell@cup.portal.com), or packet (KØOV @ WB6YMH-2.#SOCAL.CA.USA.NA)

Mother Nature Hides It Well

Repeaters in Southern California are buzzing with discussions of one of the longest and most difficult RDF efforts in anyone's memory. *73* editor Bill Brown WB8ELK and Mike Henkoski KC6CCC launched a helium balloon ATV package shortly before sunset on January 4 to get views of the annular solar eclipse from above the cloud cover.

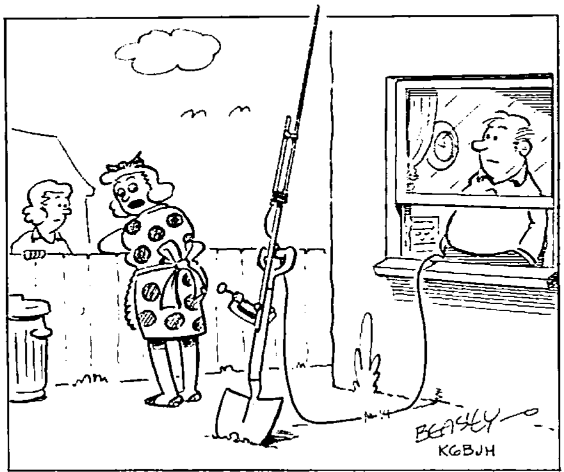
I am sure Bill is covering the ATV part of the event in his own column. But Mike and Bill missed out on the biggest challenge—recovering their equipment package. It turned out to be the best example of cooperation in years among normally competitive me-first T-hunters.

Bill's ability to predict impact points is impressive. Twenty-four hours before launch, he said that after its fall from 100,000 feet, the package would end up 52.6 miles from the launch site on a bearing line of 87.5 degrees. He missed the actual spot by only 8.5 miles.

At the time of impact Saturday night, eight mobiles full of T-hunters (B-hunters?) were converging on the mountains north of the tiny town of Anza, following the 100 milliwatt 2 meter beacon. The roads were rough and rutted. My rotating antenna mast broke from the flexing, sending WA6OPS and me home before midnight.

Hunters soon realized that there were no accessible roads to be found for closing in. A couple of the teams in four-wheel-drive vehicles got stuck and had to be winched out. But this didn't stop the intrepid do-or-die Southern California RDFers.

N6MI, N6MJN, N6XFC, and N6XTJ set out on foot, while the remaining hunters (WB6ADC, WA6CYY, WA6FAT, KK6CU, KF6GQ, WB6JPI, N6KKN, WA6PYE and KC6TNJ) stood by to take bearings on the signal and on the hikers, to keep them from get-



GEORGE ISN'T VERY AMBITIOUS --- TWO YEARS AGO, HE STARTED TO DIG A BASE FOR AN ANTENNA TOWER

ting lost in the dark. N6JSX manned his base station, plotting bearings and keeping track of stray hunters.

It was at this point that everyone began to envy balloon hunters in other parts of the country. It must be nice to be able to DF in flat cultivated terrain with roads at least every mile on a grid, worrying only about whether a farmer will show up with a shotgun. Instead, these folks found themselves at 4,500 feet elevation, shoulder-deep in wall-to-wall manzanita bushes that made it a Herculean effort to move forward while encumbered with RDF gear.

The bearing kept indicating, "It's just over the next ridge." But by dawn Sunday the hunters had had enough. Cold and exhausted, they headed out for breakfast and some rest. It was starting to rain. Most of them had 100 miles to drive to get home.

Round Two

When we got up and heard that the package had not been found and that a storm front was due soon, WB6GCT and I headed back out to the area in his 4WD Isuzu. The beacon was still strong. We spent the morning and early afternoon driving, walking, DFing and peering through binoculars into the foggy hills. One promising road ended up in the back yard of a local resident, Chris Christensen. It turned out that Chris had "back of his hand" knowledge of the hills, where he had frequently gone horseback riding.

We inquired about roads into the area where the bearings showed the greatest promise. "You can't drive in," he said, "but I can show you the old horse trails." With that, he took off at a rapid gait and we had little choice but to hustle after him.

We followed the bearings of my TDOA RDF set, which gave clear indications from the high spots. But soon a big storm front with wind and sleet arrived, forcing us to turn back. We exchanged phone numbers and Chris hinted that he might try to find the box on his own when the weather cleared.

KC6CCC told the T-hunt crowd on the repeater Sunday night that the 2 meter beacon batteries would die within 24 hours. That motivated WB6HPW and three of the Saturday night hunters to make a last-ditch effort. They headed out to the site at dawn to find cloudy weather and six inches of snow on the ground. Would it still be on the air? Yep, still going!

It was another day of searching for roads and tramping through the snowy manzanitas. Local residents WB6MMA, W6RID, and NA6S assisted with four-wheeling and hosted the hunters' families. N6XTJ flew over the area to attempt aerial bearings.

Suddenly, at 1715 hours, the signal level began to flutter. Either the battery was dying or the package was moving. Sure enough, Chris and his brother-in-law had set out after work. With no RDF gear, following the line of bearing we had given Chris Sunday, they discovered it on a hillside less than 300 feet beyond Sunday's quitting spot. It had crashed into the manzanitas three-quarters of a mile from the nearest accessible road.

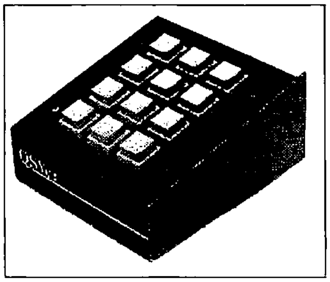
Even though some hunters expressed disappointment that a non-ham had found the equipment, they all were glad they had participated in Mother Nature's No-Holds-Barred Hunt, as it came to be called. "Bill," they're asking, "when is the next launch?" 73

Photo C. Sometimes a judge is stationed at each fox transmitter. In other hunts, there is only a flag and a special punch. Hunters must punch their cards at all five transmitters before racing to the finish line.

Number 18 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier



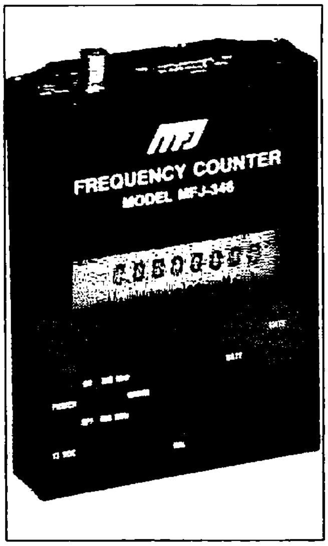
INTERNATIONAL RADIO AND COMPUTER

International Radio and Computer is offering QSYer keypad frequency selectors for ICOM, Kenwood and Yaesu radios. The IC-QSYer will operate the following unmodified rigs: IC-275/375/475/575/725/726/735/736/761/765/781 and R7000/9000. It will also control the IC-751A and R-71 with ICOM UX-14 interfaces installed. The KW-QSYer will control the following transceivers: TS-450S/690S/850S/950S with no interface required; TS-940S (/AT) with IF-10B interface installed; TS-440S(/AT) and R-5000 with IC-10-chip set installed; TS-140S/680S with IF-10C interface installed; TS-711A(-E)/811A(-B, -E) with IF-10A interface installed. The Yaesu QSYer is available for FT-736R, FT-757GX, FT-757GX/II, FT-747GX, FT-767GX, FT-990, FT-1000 and Heath SB-1400.

QSYers provide high-speed frequency entry and will automatically select the proper mode (CW/LSB/USB, etc.) for the selected frequency. They install literally in seconds to the transceiver's computer interface connector on its rear panel. Automatic antenna tuners and linear amplifiers work with the QSYer attached, just as if frequencies were entered the old way. The QSYer's lightning-fast frequency selection and automatic mode selection provide a competitive edge.

For prices and more information, contact *International Radio and Computer, Inc., 3804 South U.S. 1, Fort Pierce, FL 34982; (407) 489-0956, Fax: (407) 464-6386.* Or circle Reader Service No. 201.

MFJ



MFJ Enterprises has released a new frequency counter, the MFJ-346. The MFJ-346 measures frequencies up to 600 MHz with utmost accuracy. It has a 10-digit LCD readout with large 1/4-inch digits that are visible even in direct sunlight. It is a perfect companion for MFJ's SWR Analyzer. It can also be used for exact frequency measurements of handheld FM transceivers, measuring frequencies of HF transmitters/transceivers, and even measuring unknown frequencies when placed near mystery antennas. It also measures LO signals in receivers and reads oscillation frequency ol classic regenerative receivers.

The MFJ-346 uses high-speed ASIC and custom LCD technology. Four gate times let you select various frequency resolutions. It has an accuracy of 1 ppm. It is priced at $189.95. For more information, contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323-5869, (800) 647-1800, Fax: (601) 323-6551.* Or circle Reader Service No. 206.

AUSTIN ANTENNA

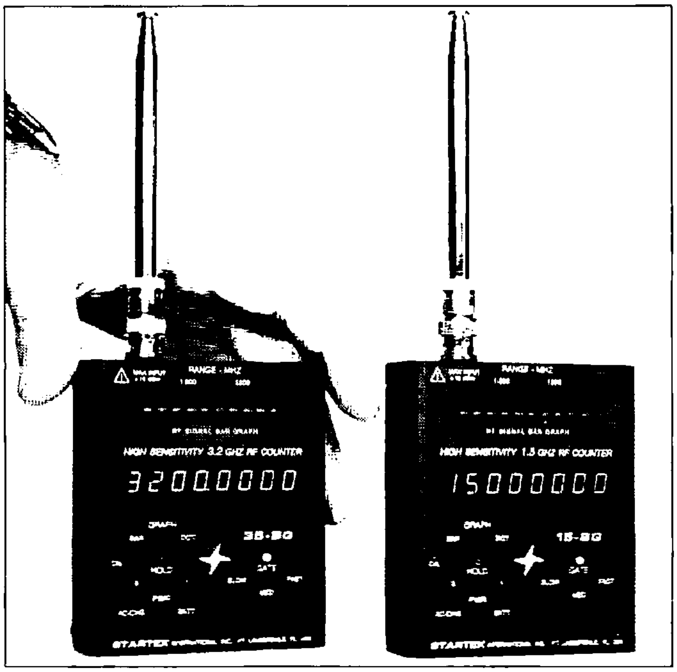
Austin Antenna is offering FREE software to facilitate the design of inductors, chokes and ferrite toroids. Several capabilities are included in the software. Inductance can be calculated from turns, diameter, wire size and coil length, and vice versa. You can build inductors using wire that you have on hand. Straight wire inductors and ferrite toroid design rules are covered as well. Inductance can be determined from inductive reactance. Also included in the program is the inductance calculation for a short-loaded dipole. Finally, construction details are determined for building capacitors from double-sided printed circuit boards. Invaluable for the hobbyist and experimenter alike, this software is a worthwhile addition to every lab. (VGA required.)

Please send $5 to cover 5-1/4" floppy, copying, mailer, postage and handling, to *Austin Antenna, 10 Main Street, Gonic NH 03839; (603) 335-6339, Fax: (603) 335-1756.* Or circle Reader Service No. 205.

DANIEL A. FORT PRODUCTIONS

"CQ Field Day" is a new amateur radio video showing what it takes to excel on Field Day. It follows the award-winning Conejo Valley Amateur Radio Club from setup through wrap-up. This fast-paced 30 minute video brings you right up to the mountaintop site so that you can experience all the frustration and elation of a modest-sized club setting up a 22 Alpha operation, then topping the overall list by scoring an amazing 23,500 points. This documentary is valuable to anyone who participates in Field Day. It is also an impressive demonstration of amateur radio in action. It is narrated by Gordon West WB6NOA, who explains every detail in non-technical terms.

The tape is priced at $19.95, plus $3 for shipping. California residents add $1.55 sales tax. For more information, Contact *Daniel A. Fort AA6LM, P.O. Box 11324, Costa Mesa CA 92627-0324; (714) 546-5709.* Or circle Reader Service No. 208.



STARTEK INTERNATIONAL

Two new Pocket Counters™ from Startek are actually ultra-high-sensitivity RF detector-counters with 2" 10-segment LED signal-strength bar graphs. The bar graph functions independently from the digital frequency counter and will indicate the relative strength of an input signal at any frequency from 500 kHz to 3.5 GHz. "Dot graph" or "bar graph" operation is switch-selectable and the sensitivity is adjustable. The bar graph is ideal for locating or adjusting an RF signal. The "digital frequency counter" has a range of 1 MHz to 1.5 GHz on model 15-BG, and 1 MHz to 3.2 GHz on model 35-BG. A 1 ppm TCXO time base is standard, with provisions for an optional ultra-high-stability TCXO. A factory-installed internal NiCd battery pack and 110 VAC adapter/charger are also standard. Although small enough to fit in a shirt pocket, these bar graph counters out-perform many larger, much more expensive models.

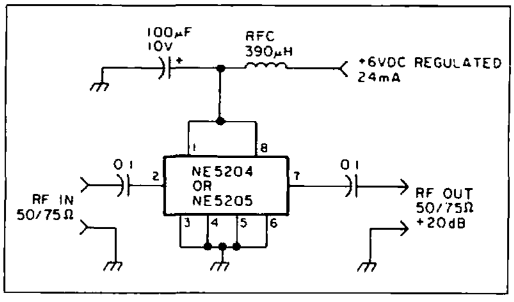
Model 15-BG is priced at $220, Model 35-BG is $265, and telescoping antenna TA-90 and vinyl carrying case CC-90 are $12 each. For more information, contact *Startek International Inc., 398 NE 38th Street, Ft. Lauderdale FL 33334; (305) 561-2211, (800) 638-8050, Fax: (305) 561-9133.* Or circle Reader Service No. 202.

CIRCUITS

Number 22 on your Feedback card

Great Ideas From Our Readers

Have a quick'n'easy circuit idea? Share it and get a one year subscription or extension to 73! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, *73 Magazine*, Peterborough, NH 03458.



An AF-to-UHF Broadband Preamplifier

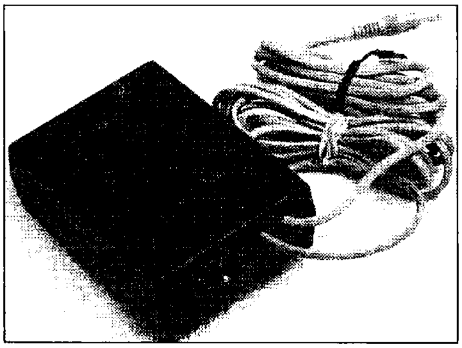
Need a simple preamp to pep up a tired old receiver? Or to amplify a weak signal so you can more easily measure it on your frequency counter or oscilloscope? Or to increase the output of your signal generator? The Signetics NE5204 or NE5205 solves this problem with a fixed gain of 20 dB and requires only four external components.

The NE5204 is flat ±0.5 dB from DC to 200 MHz, and down −3 dB at over 350 MHz. The NE5205 is flat ±0.5 dB from DC to 450 MHz, and down −3 dB at over 600 MHz. Inputs and outputs are perfectly matched to 50 or 75 ohms impedance. The noise figure is 4.8 dB at 75 ohms and 6 dB at 50 ohms. Each 8-pin IC draws 24 milliamperes at +6 VDC. Because the noise figure is higher than is usual in VHF/UHF circuits, these ICs are recommended for use from low audio frequencies to over 10 meters, or with test equipment where the noise figure is of less importance.

The circuit, shown in the figure, is simplicity itself. The +6 VDC supply voltage should be regulated. Either a 78L06 or 7806 3-terminal regulator is recommended. Nominal current drain is 24 milliamperes, 30 mA maximum. Values indicated are suitable from audio to above 10 meters, with overlaps at each end. Larger or smaller input/output capacitors, and the RFC, may be used, depending on the frequency range over which the preamp will be used. Be sure to connect all pins, as shown in the schematic.

Although these ICs are specified from DC to UHF, both input and output must be isolated from DC. Thus, they are useful only from low AC frequencies up to their high frequency limits. Although the NE5204 is cheaper than the NE5205, each chip costs several dollars, less than $5. Because of their simplicity in use, and the lack of a lot of external components to achieve the same 20 dB gain and extremely wide frequency bandpass, use of either of these ICs will be both easier and cheaper than any other approach to achieving similar results. And the physical size of the entire preamplifier is small enough to easily incorporate inside a receiver, frequency counter, etc.

J. Frank Brumbaugh KB4ZGC
Bradenton FL



ELECTRON PROCESSING

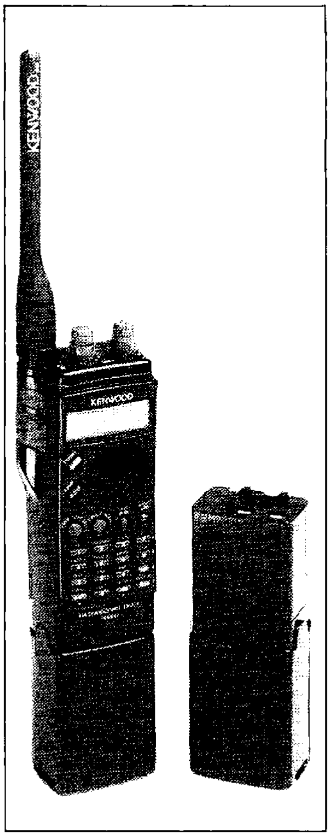
Electron Processing has introduced a means for individuals and small groups to put a repeater on the air quickly and without excessive expense. Ease of use and low cost make the Personal Repeater Interface BRI-2 ideal for HT range extension, "starter" or mobile/portable repeater operation. No internal modification of your equipment is needed as it connects to the external speaker output of your receiver and the mike jack of your transmitter. Enjoy great HT coverage into the local repeater by using the BRI-2 and your base transceiver (and scanner) to relay your HT signal to the repeater for "cordless" hamming from home!

All the basic necessities of repeater or relay operation are provided. Audio isolation and PTT transmitter keying using a VOX circuit makes connection to your equipment simple. Just wire your microphone plug! A five-second "hang" time and a three-minute "time-out" timer are both provided (and can be disabled). Powered by a 9 volt battery (12 VDC available), the BRI-2 is also ideal for emergency communications and temporary relays.

The BRI-2 sells for $50, plus $5 for shipping and handling. For more information, contact *Electron Processing, Inc., P.O. Box 68, Cedar MI 49621; (616) 228-7020.* Or circle Reader Service No. 203.

W & W ASSOCIATES

W & W Associates has introduced new replacement batteries for Kenwood's TH27A/47A: a PB14S battery that is 12V at 750/800 mAh, and a replacement battery for Kenwood's PB-13, 7.2V at 750/800 mAh. For prices and more information, contact *W & W Associates, 29-11 Parsons Boulevard, Flushing NY 11354; (718) 961-2103, (800) 221-0732, Fax: (718) 461-1978.* Or circle Reader Service No. 204.



IIX EQUIPMENT

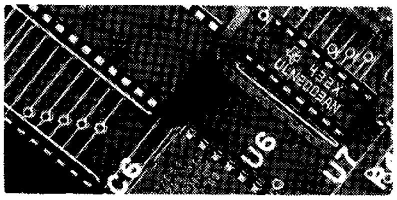
In celebration of 10 years service to the amateur radio fraternity, IIX Equipment Ltd. has announced three additions to its ever-expanding line of tower accessories and vehicle radio mounting systems. The SO-4 is an adjustable tower stand-off bracket that mounts on tapered tower sections or masting and will adjust up to 30 degrees off the vertical. The TT-3 quadpod, a new addition to the 6- and 9-foot quadpods, will stand three feet high and will mount a vertical antenna or mast with up to 2" o.d. The third item is a tower coax standoff, designated CA-1, which will hold multiple coax cables 14" off the tower face. All items feature rugged IIX construction and hot dipped galvanized finish. A free 10th anniversary catalog and price list covering all IIX products is available from *IIX Equipment Ltd., 4421 W. 87th St., Hometown IL 60456; (708) 423-0605, Fax: (708) 423-1691.* Or circle Reader Service No. 209.

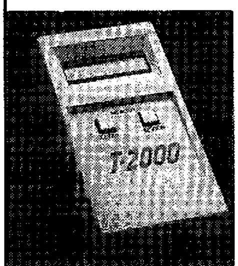
TELEX HY-GAIN

Telex Hy-Gain has introduced two new high-power current baluns for yagi and dipole antennas. Their primary function is to provide the correct current path between unbalanced coaxial cable and a balanced antenna feedpoint and prevent the shield from radiating. The new baluns match the size of the older BN86 and can be used as a direct replacement.

These baluns have an impedance of 50 ohms and a frequency range of 1.6 to 30 MHz. Insertion loss is less than 0.1 dB; SSB/CW power handling to 4,000 watts PEP, 2,000 watts average. They offer RTTY power handling to 2,000 watts continuous.

The suggested list price for the yagi balun (Model BN4000B) and the dipole version (Model BN4000D) is $107 (each). For more information, contact *Telex Hy-Gain, 9600 Aldrich Avenue South, Minneapolis MN 55420; (612) 884-4051, Fax: (612) 884-0043.* Or circle Reader Service No. 207.





Number 19 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

APR 4

ROCHESTER, MN The Rochester ARC will host their 15th annual Rochester Area Hamfest Computer/Electronic Show at John Adams Jr. High School, 1525 31st St. NW. Indoor Flea Market. Free parking. Talk-in on 146.22/146.82 MHz, WØMXW rptr. Contact ***Rochester ARC, Attn: N6VB, 6982 Indigo Ct. NW, Rochester MN 55901. (507) 280-7751*** (enter 1# and follow instructions).

COLUMBUS, IN The Columbus ARC will hold a Hamfest at Bartholomew County 4-H Fair Ground's Women's Bldg. on State Rd 11, from 8 AM-2 PM. Set-up Fri. 6-10 PM; Sat. 6 AM. Admission $3. 8' tables, $6. Talk-in on 146.790/.190. Make reservations through ***Marion Winterberg, 11941 W. Sawmill Rd., Columbus IN 47201. (812) 342-4670.***

ALBERTVILLE, AL The First Annual Marshall County HamFest, sponsored by the Marshall County ARC, will be held at Albertville Recreation Center from 8 AM-4 PM. Easy access. Overnite security. Tailgating. Free Parking. VEC Exams Friday night setups available. Admission $2; children under 12 free. Talk-in on 147.06+, alternate 145.11-. Contact ***Marshall County ARC, c/o Ann Jordan KC4UUV, 134 Bearden Rd., Albertville AL 35950. (205) 878-0880.***

APR 4-5

SPOKANE, WA The 15th Annual Inland Empire Amateur Radio Hamfest will be held at the Spokane Youth Sports Bingo Hall, East 2230 Sprague Ave. Space reserved for self-contained RVs. Admission free to dealers and their employee. 6' tables $10; 8' tables $12. Set-up Fri. from 1 PM-6 PM. Gordon West WB6NOA is the featured speaker. Contact ***Inland Empire Hamfest Committee, S. 1405 Crestline, Spokane WA 99203. (509) 534-8443.***

APR 5

SOUTHINGTON, CT The Southington ARA will hold a Computer/Ham Radio Flea Market at Southington High School on Pleasant St., from 9 AM-1 PM. Free parking. Admission $3. One vendor-aid admitted free. Reserved 6' tables $14; $18 at the door. Doors open for vendors unloading at 7 AM. Talk-in on 146.28/.88, 144.47/145.17, 222.20/224.80, 449.25/444.25. To reserve tables, send SASE to ***Southington ARA, PO Box 873, Southington CT 06489.*** Make checks payable to ***S.A.R.A.*** VE Exams, all classes, pre-registration only. Send SASE to ***PO Box 873, Attn: Exams, Southington CT 06489.***

GROSSE POINTE WOODS, MI The South Eastern Michigan ARA will conduct its 34th Annual Hamfest/Swap-N-Shop/Computer Show at Grosse Pointe North High School, 707 Vernier Rd., from 8 AM-2 PM. ARRL Forum. VEC Exams. Advance tickets/vendor passes are $2 each with 1 pass req'd for each member of your party. Talk-in on 146.74-.600. Contact ***Thomas J. Orlicki N8HLY, PO Box 646, St. Clair Shores MI 48080-0646. (313) 527-3497.***

ST. JAMES, NY The Suffolk County RC will hold its indoor Hamfest at the St. James Lutheran School, Moriches Rd. and Woodlawn Ave., from 9 AM-3 PM. Admission is $5; children under 12 admitted free. VE Exams. Free parking. Wheelchair accessible. Talk-in on 145.210/144.610. Contact ***Jim Heacock KA2LCC, (516) 473-7529.***

LONGMONT, CO A combined Hamfest/Computer Swap, sponsored by the Longmont ARC, will be held from 0800-1500 hours at the Boulder County Fairgrounds, Nelson and Hover Rds. Free parking. Commercial exhibitors. Admission $3. Tables $7 (admission ticket required). VE Exams at 1300 hours, call ***(303) 530-2903*** for info. For table reservations remit to ***Longmont ARC, PO Box 86, Longmont CO 80502-0086;*** or call ***Jerry Schmidt NØOUW, (303) 772-6739.*** Talk-in on 147.87/.27 146.52 simplex.

APR 11

FERGUS FALLS, MN The Lake Region ARC will sponsor their 5th annual Hamfest from 8 AM-3 PM at the Otter Tail County Fairground's Hockey Arena, Hwy. 59 So. Set-up Fri. at 4 PM. Overnight security. Camping spots Fri. night only. ARRL Forum, Army MARS meeting, commercial dealers, flea market. Advance tickets $3, $4 at the door. 6' tables $4. Walk-in VE Exams begin at 9 AM, first como, first served. Call ***(218) 826-6274,*** or write to ***Keith McKay N8FKF, Rt 1 Box 46, Battle Lake MN 56515.***

HUNTINGTON, WV The TARA VE Team will hold test sessions at Our Lady of Fatima church school class rooms, 545 Norway Ave., at 10 AM. Registration is at 9:15. Have your ID and Form 610 checked prior to the exam. Contact ***Jim Baker K8KVX, (304) 736-6542*** to confirm location and date.

CHESAPEAKE, VA Chesapeake ARS, Inc. will sponsor "Springfest 92" at the Indian River Recreation Community Center, 2250 Old Greenbrier Rd. and South Military Hwy. (US 13), from 9 AM-3 PM. Set-up Fri. 6-9 PM; Sat. 8-9 AM. Wheelchair accessible. VE Exams by the Chesapeake DX Assn. Advance tickets $3, $4 at the door. Dealers tables $10; Flea Market tables $6. Dealer Contact: ***Greg Hemmings N4WVE, (804) 547-1632.*** Flea Market Contact: ***Rob Holt N4SFH, (804) 485-7703.*** Please, no calls after 10 PM. Reservations must be finalized by Apr. 1.

OTTAWA, ONT., CANADA The Ottawa Valley Mobile RC will hold its annual Flea Market from 0900-1600 EST at the Canterbury High School. Talk-in on 147.30/.90. Contact ***Ken Barry VE3KJB, (613) 746-4823.***

UPPER SADDLE RIVER, NJ The Chestnut Ridge Radio Club will sponsor its annual Flea Market from 8:30 AM-2 PM, at the Education Bldg., Saddle River Reformed Church, E. Saddle River Rd., corner Weiss Rd. Donation $2. Tailgating $7. Tables $10 each. Talk-in on 146.955 rptr. Contact ***Jack Meagher W2EHO, (201) 768-8360.***

LAWTON, OK The Lawton-Fort Sill ARC will hold their 45th annual Hamfest at the County Fairgrounds, from 8 AM-5 PM. No pre-registration necessary except for table space. Admission $4. Tables $8, including admission. Talk-in on 146.91/.31. Contact ***Bob Morford, 1415 N.W. 33rd St., Lawton OK 73505.***

AUBURN, NY The Auburn ARA will hold its annual Hamfest at the Auburn High School Gymnasium from 8 AM-4 PM. Tailgating $2. Admission $4, Flea Market tables $5. Talk-in on 146.40/147.00.

APR 11-12

WEST WINDSOR, NJ The 17th Annual Trenton Computer Festival will be held at Mercer County Community College. Packet Radio Conference, VE Exams, License Study Courses, Flea Market. Call ***(609) 655-4999*** for info.

NATCHEZ, MS The Old Natchez ARC will hold a Hamfest from 8 AM-5 PM Sat. and Sun. at the Natchez Convention Center. VE Exams. Admission $3. Tables $15, contact ***K5SVC, (601) 442-0973.*** Talk-in on 146.91. 200 RV spaces available on-site $8/night. Contact ***N5YCZ, PO Box 604, Natchez MS 39121.***

APR 12

RALEIGH, NC The Raleigh ARS will hold its 20th NCS ARRL Convention, Hamfest/Computer Fair in the Jim Graham Bldg, NCS Fairgrounds, from 8AM-4 PM. Wheelchair accessible. Free parking; RVs welcome. VE Exams, pre-register with ***Vinca AA4MY, (919) 847-8512.*** For Hamfest info and pre-registration, contact ***Rollin Ransom NF4P, 1421 Parks Village Rd., Zebulon NC 27597. (919) 269-4406.*** Advance tickets $5, $6 at the door. Talk-in on 04/64.

ROCKFORD, IL The Rockford Hamfest/Computer Fest 92 will be held at the Rockford Metro Center from 8 AM-3 PM. Talk-in on 146.610/146.010, 223.880/222.280. For table reservations call ***Joe*** at ***(815) 399-6995;*** or ***Ben, (815) 633-4122.*** For advance tickets, send SASE, and check made payable to ***RARA,*** to ***PO Box 6931, Rockford IL 61125-6931.*** Advance tickets are $4.50.

WEBSTER, MA The Eastern Connecticut ARA will sponsor a Ham Radio/Computer Flea Market from 10:30 AM-3 PM at the Point Breeze Restaurant. Admission $3. Tables $10. Talk-in on 147.225/.825. Contacts: ***Roger KA1LMN, (203) 928-4883; Gary N1BBI, (203) 974-2564; Chuck WB1AOC, (203) 774-1723.***

FRAMINGHAM, MA The Framingham ARA will hold its Spring Flea Market and Exams at Framingham High School, A Street, beginning at 10 AM (early bird buyers, 9 AM, $5 admission). General admission $2. Set-up at 8 AM. Table cost is $12 and includes one free admission. Pre-register for all tables and exams. Contact ***Jon Weiner K1VVC, (508) 877-7166.*** Send check payable to ***FARA, PO Box 3005, Framingham MA 01701.*** To register for exams, send check for $5.40, payable to ***ARRL/VEC*** to ***Dick Marshall WA1KUG, 37 Lyman Rd., Framingham MA 01701.*** Exam walk-ins will not be accepted after 10 AM.

APR 18

JOPLIN, MS The Joplin ARC will sponsor a Hamfest at the National Guard Armory, 2000 W 32nd St. VE Exams, Flea Market, Auction, unusual CW Contest. Tickets $5 or 3/$12.50. Tables (with ticket) $10. Additional tables $5 each. Send SASE and check to ***Joplin ARC, PO Box 2983, Joplin MO 64803.***

BOWLING GREEN, KY The Kentucky Colonels ARC, Inc., will sponsor a Hamfest from 8 AM-4 PM (Central Time). VE Exams. Wheelchair accessible. Camping. Tailgating. Adults $4, children under 12 free with paid adult. Tables $10 (reservations preferred). Contact ***Denver Eadens N4WWA, (502) 777-3681.*** Talk-in on 146.25/146.85.

APR 19

CAMBRIDGE, MA A Tailgate Electronics/Computer/Amateur Radio Flea Market will be held at Albany and Main St. from 9 AM-2 PM, by the MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club. Admission $2. Free off-street parking. Sellers $8 per space at the gate, $5 in advance—includes 1 admission, set-up at 7 AM. For reservations and info, call ***(617) 253-3776.*** Reserve before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/444.725-pl 2A-W1XM reptr.

APR 24

DAYTON, OH The Southwest OH Chapter of the Quarter Century Wireless Assn. will hold its 1992 annual QCWA Banquet Fri., Apr. 24, the first evening of the Dayton Hamvention. Neil's Heritage House has an outstanding meal for us. C.O.D. bar is at 6:30 PM, the banquet starts at 7:30 PM. George Wilson W4OYI, President of ARRL will be our speaker. Tickets $16 each, reservations required. QCWA membership is not a requirement to attend. For tickets/info, contact ***Bob Dingle KA4LAU, 1117 Big Hill Rd., Kettering OH 45429-1201. (513) 299-7114.*** Please make all checks payable to ***Robert L. Dingle, Treas. Chapter 9.***

APR 24-26

DAYTON, OH Dayton Hamvention 1992, sponsored by the Dayton ARA Inc., will be held at the Hara Arena Fri., Sat., and Sun. Giant 3 day Flea Market. Free bus service. License Exams Sat. and Sun., by appointment only. Send FCC form 610 (Aug. 1985 or later), with requested elements shown at the top of the form; a copy of present license, and a check for $5.40 (payable to ***ARRL/VEC*** to: ***Exam Registration, 8830 Windbluff Point, Dayton OH 45458-2855;*** before Mar. 23. No FAXes or Express Mail please! For general info contact ***Hamvention, Box 964, Dayton OH 45401-0964. (513) 454-1456.*** For lodging info, call ***(513) 223-2612*** (no reservations by phone), or write ***Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton OH 45402-2400;*** or refer to our 1991 Hamvention program for a listing of hotel/motels located in the Dayton area. For Flea Market info, call ***(513) 767-1107.***

APR 26

SOUTHWICK, MA The Hampden County Radio Assn. will sponsor a Flea Market at the Southwick Recreation Center, Powder Mill Rd., Off Rt. 57, beginning at 9 AM. Set-up at 7 AM. Admission $2. Tables $7 in advance; $10 at the door. VE Exams start at 10 AM; registration is from 9-9:30 AM. Talk-in on 449.175, 146.52. Contact ***Fred Gore KA1TBS, 40 Birchwood Rd., (413) 569-3579,*** or ***Charlie Dunlap K1II, 66 Vining Hill Rd., Southwick MA 01077. (413) 569-5988.***

MILFORD, CT The coastline ARA will sponsor All Class VE Exams at the Fowler Bldg., 145 Bridgeport Ave., at 12 noon. Contact ***Gary NB1M, (203) 933-5125; Dick WA1YQE, (203) 874-1014.*** Walk-ins welcome.

WELLESLEY, MA The Wellesley ARS will sponsor a Special Event at the Wellesley Senior High School parking lot, 50 State St., from 9 AM-2 PM. Wheelchair accessible. Admission $2. Talk-in on 147.03/.63 Wellesley rptr. Contact ***Gerry Driscoll NV1T, (617) 444-2686.***

MAY 2

CEDARBURG, WI The Ozaukee RC will sponsor its 14th Annual Cedarburg Swapfest from 8 AM-1 PM at the Circle-B Recreation Center, Highway 60 and County I (located 20 miles north of Milwaukee, west of Grafton). Admission is $2 in advance, $3 at the door. 4' tables $3. Set-up at 6:30 AM. License exams start at 9 AM. Talk-in on 146.37/.97 and 146.52. Send an SASE to ***ORC Swapfest, 11448 Laguna Dr., Mequon WI 53092. Phone (414) 242-4995.***

OWEGO, NY The Southern Tier ARC will sponsor the Southern Tier Hamfest at Marvin Park Fairgrounds, Rte. 17C and Exit 64, from 8 AM-4 PM. 33rd Annual Banquet. VE Exams. ARRL Forum. Indoor and outdoor Flea Market. Tailgating. Advance tickets $3, $4 at the gate. Tailgate $2 extra. Tables $15. Banquet (includes general admission), $18 per person in advance. Contact ***STARC, PO Box 7082, Endicott NY 13760.***

MAY 2-3

ANDERSON, SC The Blue Ridge ARS will sponsor the Greenville Hamfest/Electronic Flea Market at the Anderson County Fairgrounds on Sat. from 8 AM-5 PM; Sun. 8 AM-3 PM. Walk-in License Exams. Indoor/Outdoor Electronic/Computer Flea Market. Free Parking. Camping. Early dealer/flea market set-ups with advance registration. Advance tickets $4, $5 at the gate. To register, send SASE to ***Blue Ridge ARS, Inc., PO Box 6751, Greenville SC 29606.***

MAY 3

SANDWICH, IL The DeKALB Hamfest, sponsored by Kishwaukee ARC, will be held from 8 AM-1 PM at the Sandwich Fairgrounds, Suydam Rd., rain or shine. (Please use the main entrance.) Overnight camping without hook-ups. Free outside tailgating. Advance tickets $4 each, by Apr. 1, or $5 at the gate. Inside tables $10 each. Make checks payable to ***Kishwaukee Amateur Radio Club.*** Contact ***Howard Newquist WA9TXW, Box 264, Sycamore IL 60178.*** Send SASE for info. Talk-in on 146.13/.73 and 146.52.

YONKERS, NY The Metro 70cm Network will sponsor a Giant Electronic Fleamarket, 9 AM-3 PM, rain or shine, at the Lincoln High School, Kneeland Ave., off Yonkers Ave. Set-up at 7 AM. VE Exams. Free parking. No tailgating. Admission $4, kids under 12 free. Sellers $15 1st table, $10 ea. additional table. All tables 30" x 5'; or bring your own table at $1.80 per ft.-min. $10. Full payment is due with registration. No reserved tables or spaces will be held past 9 AM. Notification of cancellation must be received 72 hours in advance for a refund. To register, contact ***Otto Supliski WB2SLO, (914) 969-1053.*** Register early! Talk-in on 440.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 MHz; 443.350 MHz PL 156.7.

SULLIVAN, IL The Moultrie AR Klub will sponsor a Hamfest at the Moultrie County 4-H Fairgrounds, 5 miles east of Sullivan IL on the Caldwell Rd. VE Exams 9 AM-12 noon, by pre-registration. Please send proper documents and a check or MO for $5.40 made payable to ***ARRL VEC.*** Send to ***Ralph Zancha WC9V, 502 E State St., Lovington IL 61937.*** No walk-ins. No charge for flea market set-up. Admission is $4 per person over 14 years old. Tables $8. Call ***Ralph, (217) 543-2178*** days; ***(217) 873-5287*** eves. Or write to ***M.A.R.K., PO Box 91, Lovington IL***

61937. Talk-in on 146.055/.655 and 449.275/ 44.275.

BEMIDJI, MN The Paul Bunyan ARC will hold its annual hamfest at the Bemidji Moose Lodge from 8 AM–3:30 pm. A pancake breakfast will be served at 8 AM. VE Exams, Flea Market. Talk-in on 146.13/.73. Contact ***Vern Skretvedt KA0KWM, (218) 751-5514,*** or ***Curt Johnson WB0HUJ, (218) 751-7920.*** To register for testing, contact ***John Simmons NI0K, (218) 243-2720.***

SPECIAL EVENT STATIONS

APR 4

BACKBONE MTN, MO MADRAS will operate a special event station Apr. 4, 0700Z (12 PM EST) to Apr. 5 0500 (10 AM EST). Counties will include Garret County, MD, and Mineral, Grant, and Preston Counties, WV. CW and SB, near the bottom 25 kHz of the General portion of the band on 80, 40, 20, 15 plus 28.325; also 2 meter SSB 17 and 12 may be available. QSL with SASE to ***MADRAS, PO Box 2468, Wheaton MD 20915-2468.***

APR 10

STRATFORD, CT The Stratford ARC will operate W1ORS 2300Z–0400Z to celebrate the 160th anniversary of the Shakespeare Hotel of Stratford CT. Operation will be on 28.360 MHz and 14.240 MHz±. For QSL, send QSL and SASE to ***Wes Ouinn KD1DC, 30 Coolridge Rd., Milford CT 06460.***

APR 11-12

MYSTIC, CT The Titanic struck an iceberg and sank on the evening of Apr. 14, 1912. To commemorate the 80th anniversary of this event, Tri-City ARC will operate Station KA1BB from the Mystic Seaport Museum, from 1300Z–2100Z Sat. and Sun. On these dates, in recognition of continued Amateur Radio community service, admission to the Seaport for Amateurs and their immediate families will be free upon presentation of a valid license. Look for KA1BB in the middle of the General class phone and CW bands -10, 15, 20 and 40 meters, and the center of 10 meter Novice phone band. Send SASE and #10 envelope to ***Tri-City ARC, Box 686, Groton CT 06340.***

BAY CITY, TX The Matagorda Co. ARC will operate WA5SNL or any other Matagorda Co. ARS 0000Z–2400Z in conjunction with the Bay City Heritage Day Festival. We will operate all bands in all modes. For QSL, send SASE to ***N5QWF, 4404 Doris St., Bay City TX 77414.***

APR 18-19

HONOLULU, HI Hawaii Army MARS members will operate WH6D to commemorate the 50th anniversary of Doolittle's Raid on Tokyo. Activites are planned for all bands, all modes, including the Novice subbands. Look for us at the lower portion of each subband, 1800Z Apr. 18–1800Z Apr. 19. For QSL, please send your card and SASE to ***Joe Hao, 3251 Pakanu St., Honolulu HI 96822.***

APR 25

PINE BLUFF/FORDYCE, AR The Jefferson County ARC will operate N5RHI from 1500 UTC-2300 UTC, to celebrate "Fordyce on the Cotton Belt" in conjunction with Project 819. Operation will take place from Pine Bluff, AR and Fordyce, AR, as well as rail mobile from aboard the refurbished Cotton Belt Railroad Steam Engine #819. Frequencies: Phone–lower 25 kHz of 40, and 20 meter subband, and Novice portion of 10 meter subband. For certificate, send QSL and 9 x 12 SASE, with 2 units of postage, to ***Project 819 Special Event Station, 310 West Harding, Pine Bluff AR 71601.***

MARSHALLTOWN, IA The Progressive ARC, in conjunction with the Mid-Iowa Council, Boy Scouts of America, will operate N0JGB 14:00–21:00 UTC, to celebrate the 10th Anniversary of Black Powder and Dutch Oven Day at Camp Mitigwa near Madrid IA. Frequencies: 28.350/28.400, 21.300/21.350, 14.250/14.300, 147.420 and 446.250. For certificate, send QSL and SASE to ***David Young N0MVC, Box 907, Marshalltown IA 50158.***

MT PLEASANT, IA Station N0MQA will be in operation from 1400Z Apr. 25–0200Z Apr. 26, from the campus of Iowa Wesleyan College, to commemorate the institution's 150th Anniversary. CW operation will be in the Novice portion of 40 and 15 meters, while voice operation will be in the lower 50 kHz of the General portion of 20 meters, and also on the Mt. Pleasant 147.39 MHz rptr. For a special QSL, send your QSL and SASE to ***Roland Shook N0MQA, Iowa Wesleyan College, Mt. Pleasant, IA 52641.***

APR 25-26

ALTOONA, PA The Horseshoe ARC will operate Station W3QZF on the lower portion of General phone, on 40 through 15 meters, and Novice sub band on 10 meters. QSL to ***HARC, PO Box 225, Hollidaysburg PA 16648.***

APR 27-MAY 2

DAVIS MOUNTAINS, WEST TX Amateur astronomers/hams representing the Southwest region of the Astronomical League will operate Station K5GH (K5 Galaxy Hunters) at the 11th annual Texas Star Party, located near the Univ. of Texas's McDonald observatory in the Davis Mountains of West Texas. The Texas Star Party is a gathering of amateur and profesional astronomers from around the world. Frequencies ±QRM: 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical theme QSL card, send QSL and SASE to ***K5GH-TSP, 721 White Dr., Garland TX 75040.***

MAY 2-3

U.S.S. OLYMPIA The Olympia RAC will operate Station WA3BAT from aboard the U.S.S. Olympia, May 2, 1400–2200 UTC May 3, to commemorate the 94th anniversary of Admiral Dewey's triumph over the Spanish fleet at the Battle of Manila Bay. CW-7.065 2200–0200 UTC; Phone: 3.895, 7.245, 14.245, 21.365, 28.365, all frequencies ±5 kHz. For certificate, send QSL with operators number and a 9 x 12 inch SASE to ***Olympia RAC, PO Box 928, Philadelphia PA 19105.***

Number 20 on your Feedback card

UPDATES

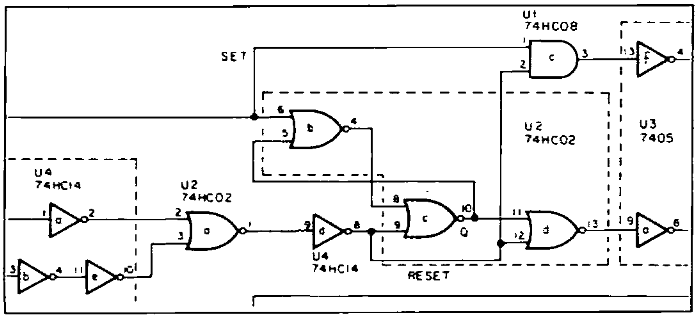


Figure. Partial schematic of the GaAsFET preamp sequencer showing new IC pin numbers corresponding to the PC board layout.

GaAsFET Preamp Sequencer

See the above article on page 8 of the March 1992 issue by Ron Klimas WZ1V. Although the schematic is correct as printed, if you build the circuit using the PC board the IC pin numbers will be different. See the Figure for a schematic that reflects the pin number changes on the PC board layout.

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

New Excitement

In the four months since my column on 9600 bps efforts via UoSAT-OSCAR-14 and UoSAT-OSCAR-22, there have been many changes for current and future users. Activity is up, more information is available on modems and the SBBS (satellite bulletin board system) operations have moved to U-O-22. The volume of interesting pictures, programs and news has increased dramatically. Check my December 1991 column for details on getting started with fast packets from space.

Terrestrial packet radio activity and satellite-based systems have several parallels, but also significant differences. On earth, congestion on a packet channel can usually be heard. When several stations are active on a single frequency, a user's TNC (terminal node controller) will wait to transmit when other signals are detected. For satellite work, the only station hearing collisions is the satellite itself. Hundreds of stations in the satellite's coverage area will listen for its prompt, and transmit simultaneously when the space-based system declares an available slot for interactive access or a possible opening in the broadcast queue.

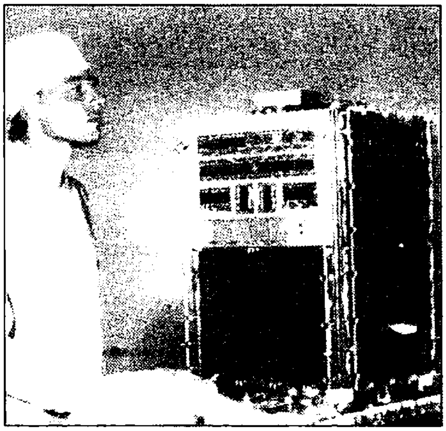


Photo A. U-O-5 (U-O-22) preparation at Kourou, French Guiana prior to launch—from NK6K via U-O-14.

Transactions between the users and the satellite are crossband and full duplex. Thanks to the program PB.EXE for PCs and clones, a station monitoring the downlink even without transmitting has an excellent chance of collecting a complete listing of the onboard directory and retrieving many complete files just by employing the "grab-all" feature while tuned to U-O-22's downlink of 435.120 MHz FM.

For those who can transmit to U-O-22 on 145.900 MHz FM, holes in files can be plugged by sending "fill" requests and directories can be updated much faster with transmitted directory requests.

In recent months changes have been made to the user software, especially PB.EXE. The new software can be downloaded from the satellite using the old software. The December version of PB.EXE had some bugs that required user intervention to correct errors. The latest edition from the University of Surrey and Jeff Ward GØ/K8KA was released in mid-February and took care of many of the problems encountered with the pre-Christmas version.

Once the program PB.EXE is started, there's plenty to do keeping antennas aimed and frequencies centered, but the keyboard work to get files from the satellite has diminished. Useful additions to PB.EXE include an interactive directory that allows the user to view the contents during a pass as it receives updates, and to make changes to file status. The default is that all files be "grabbed." The user can change this to "Never" get the file, "Automatic" fill or "Priority" collection. While browsing through the list, picture files like ITAMSAT.JPG or JAS-1.JPG may look interesting, while gateway traffic and satellite data files may not. Files of interest can be tagged "A" for automatic capture or "P" for priority collection. The program will take care of the rest by requesting that the files be sent and filled as needed.

A few picture files downloaded from space are shown as photos this month. These shots of the CRT depict the wide range of images available from the SBBS. Most picture files are compressed before uploading with a compression technique called JPEG (pronounced jay-peg) which stands for "Joint Photographic Experts Group." To view these compressed images they must be converted to a form, such as GIF (Graphics Interchange Format), that can be viewed on most computers. This decompression can be done with programs like JPG2GIF (packaged with GIF2JPG) and Image Alchemy (conversions for several formats). Both are available from Handmade Software, Inc., 15951 Los Gatos Blvd., Suite 7, Los Gatos CA 95032. The shareware versions of these programs can be found on many bulletin boards and have also appeared as downloadable files on the satellite. A registered version of the JPG2GIF/GIF2JPG program set is $20, while the registered Image Alchemy package is $80.

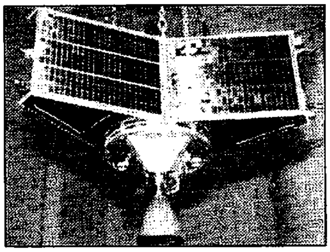


Photo B. A-O-13 ready for launch integration—picture from DB2OS via U-O-14.

JPEG files are 24-bit images that cannot be viewed directly on the typical VGA display system unless the system has a Targa board or an XGA-compatible IBM PS/2. The JPEG compression technique is also "lossy." Data is lost through the process of compression from GIF to JPG and back again. This is very noticeable if a very low Q, or quality factor, is specified when making a JPG file from a GIF image. To save space on the satellite and make uploading easier, some pictures have been over-compressed, causing loss of definition when the file is later expanded to a GIF file for viewing. A typical 150K GIF picture can be compressed to 30K without serious losses, but will become grainy with further compression.

The U-O-22 Switch

In early February Jeff Ward posted a message on U-O-14 announcing an immediate move of SBBS activity to U-O-22. The move was necessitated by difficulties with non-amateur use of the satellite by SatelLife (primary supporter of U-O-22) and other organizations. While U-O-22 worked well on amateur frequencies, the system didn't work well on the out-of-band commercial downlink.

Until further notice U-O-14 will not transmit on amateur frequencies. It will be used by SatelLife and VITA (Volunteers in Technical Assistance).

U-O-22 will be dedicated to amateur activity. The downlink will be permanently on 435.120 MHz FM. This will cause some conflict between SBBS users and CCD image enthusiasts, but this satellite has twice the program storage area of U-O-14, and a more powerful transmitter. The University of Surrey crew will be looking into onboard JPEG compression of images to save space.

Several stations have noticed that the downlink of U-O-22 is more difficult to copy than that of U-O-14. While the signal strength is stronger, there appears to be a higher BER (bit error rate). There are two possible explanations.

The primary reason some stations have problems is the design of the U-O-22 transmitter. The U-O-14 design uses a crystal-controlled modulator while U-O-22 uses a PLL (Phase-Locked Loop) modulator. The U-O-22 circuit appears to have some undesirable low-frequency cutoff characteristics. Some stations never noticed a problem, while others could not even copy the U-O-22 signals with regularity. Modifications to various systems are under study. The goal is to boost low frequency response (more bass!) in the input filtering from the receiver discriminator to the demodulator circuitry. A new 9600 bps modem from TAPR is expected soon with appropriate circuitry for full duplex and good U-O-22 receive capability.

The other reason for possible reception problems is interaction of the downlink modulator with the transputer circuitry on board the satellite. This problem is very slight, but the result is that the BER noted with U-O-14 will always be less than with U-O-22, even when the frequency response anomalies are resolved in affected ground stations. The difference is slight, but it is not correctable. In the meantime the crew at the University of Surrey are working on upgraded user software and methods to optimize amateur access of U-O-22.

Korean Hamsat

In addition to taking care of amateur operations and commercial interests, efforts are also underway in Surrey to complete another completely amateur satellite, called KITSAT, for the Korea Institute of Technology. Engineers from Korea are in England working on this project. It represents an upgraded version of U-O-22 with two lens systems on the CCD camera experiment: one for wide-angle viewing, like the current U-O-22 system, and one with telephoto capabilities. After launch, operation of the satellite will be turned over to the KARL (Korean Amateur Radio League).

Photo C. Italian microsat under construction—photo uploaded by I3RUF to U-O-14.

STS-45 Update

Four hams are scheduled for launch with STS-45 on March 23rd. As reported previously, the ham operation will be limited to voice on 2 meters, but more casual operations are expected with the ham community on earth.

The primary callsign to be used is N5WQC, belonging to astronaut David

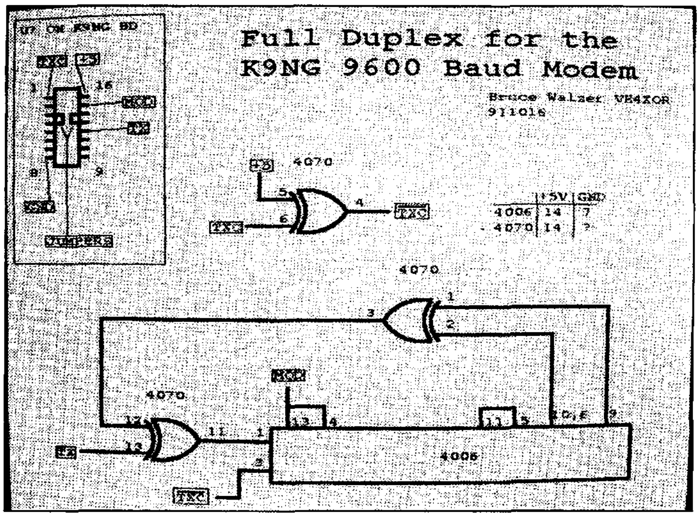


Photo D. Even schematics can be sent via satellite. This one shows modifications to a single K9NG modem to allow full-duplex operation for U-O-14 operation.

Leestma. Other hams on board include Brian Duffy N5WQW, Dr. Dirk Frimout ON1AFD, and Kathy Sullivan, who recently passed her Technician class test.

Unlike operations from the Russian Space Station *Mir*, shuttle activity is never simplex. The primary downlink is 145.55 MHz FM, but the uplinks to be used are on 144.91, 144.95 and 144.97 MHz FM. Some school activity is anticipated along with schedules over Europe, but most of the ham activity is expected to be open for random contacts. Be sure to listen on 145.55, but avoid transmitting there. 73

CIRCUITS

Number 22 on your Feedback card

Great Ideas From Our Readers

Power Supply Load Fixture

Regulated power supplies are simple to construct today, but the regulation of high-amperage supplies can be checked only with known loads. At a recent hamfest I discovered several 2-ohm 100-watt wire-wound power resistors, and immediately designed and constructed the test fixture described below and illustrated in Figure 1. With certain switches open or closed, as listed in Table 1, load resistances from 0.66 to 6 ohms are available. This table also gives the amperage drawn from the power supply for each resistive load value selected at the usual +13.8 VDC. For other voltages, Ohm's law will disclose the amperage drawn.

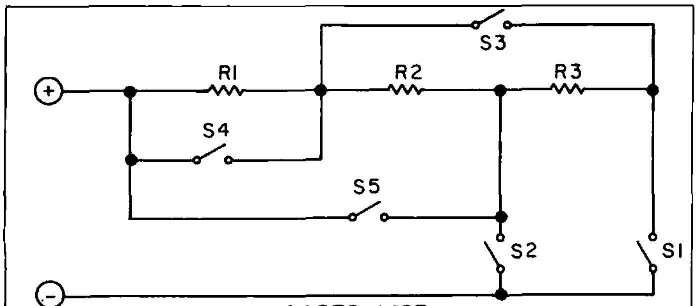
A hamfest, or a local ham who was licensed in the 1940s or 1950s, are about the only cheap sources of 20 ampere toggle switches, aircraft type. Open-knife switches can also be used, or you could use alligator clips on the ends of interconnecting wires in place of switches. Because maximum current in this circuit will be slightly more than 20 amperes at 13.8 VDC, use AWG 12 insulated stranded copper wire for all wiring. Keep your hands away from the resistors. They can get hot!

J. Frank Brumbaugh KB4ZGC
Bradenton FL

Switches*					Ohms	Amps at 13.8 VDC
1	2	3	4	5		
C	O	O	O	O	6	2.34
O	C	O	O	O	4	3.45
O	C	C	O	O	3	4.60
C	O	C	O	O	2	6.90
O	C	C	C	O	1	13.80
C	O	C	O	C	0.66	20.72

*C = switch closed; O = switch open.

Table 1. Switch positions vs. load E & I.



PARTS LIST

R1, R2, R3 — 2Ω, 100W WIREWOUND RESISTORS
S1–S5 — 20 AMP SPST TOGGLE OR KNIFE SWITCHES

Figure 1.

Number 23 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

The BayCom Program

For the past several months, we have been looking at various schemes to use a *computer* on radioteletype. From sophisticated interfaces to plug-in cartridges, there seems to be an answer for everyone. Everyone except the person on a limited budget, that is. Well, this month, I have the answer for that situation as well.

Over the past several years, a program has evolved under the hands of German hams Florian Radlherr DL8MBT and Johannes Kneip DG3RBU, with the help of Rudi Dussmann DK5RQ and Christian Lachner DL5RL, which allows a plain old PC-compatible computer to run RTTY with only a simple audio-to-TTL interface card. The BayCom terminal program has been hindered by one simple fact: The manual, prompts and help file were all written in German. Thanks to an English translation by Denis Godfrey GØKIU, the latest version of BayCom, Version 1.4, represents an exciting vehicle for getting a PC-compatible computer on packet, *without* a TNC.

From the authors of an earlier work, the widely circulated "Digicom" for the C-64, BayCom will run on an XT, AT, or 386 system, and supports all displays through VGA. It will run from either a diskette or hard disk, though the latter is clearly preferable. To dispense with one vital question quickly: No, it is not entirely interface-free. After all, you cannot just hold your mouse near the transceiver and expect to operate! No, BayCom requires a simple interface, which in essence is a simple modem board. The requirements for such a board are given in Table 1. Hardware kits for constructing a suitable modem are available from the authors (the details are given later in this column).

The program itself is modular in design, which gives it the flexibility to run on many machines. A TSR (terminate and stay resident) kernel, called L2.EXE, allows the computer to monitor the radio, even when other programs are being used. About 90K of conventional RAM is used for this program. There is no data, and I have no information regarding any testing, as to whether or not this kernel will LoadHigh with DOS 5.0 or other memory managers into high memory, or into extended or expanded memory.

Anyway, once loaded, the interface is accessed through SCC.EXE, the user interface module. Data particular to the individual station, callsign, screen parameters, and the like, is stored in an initialization file, and may be easily changed. There is even a routine, called OFF.EXE, which will unload the L2.EXE module, freeing all of the conventional RAM, provided, of course, that no other RAM resident program has been loaded after L2.EXE.

Once loaded, BayCom presents a rather typical screen for packet communication. It features about all the modes and options of TNC-based systems, all without the TNC! With many of you having expressed interest in putting PC-compatible systems on packet without investing several hundred dollars in another "box," this might be just the answer.

You can get BayCom on many local and national bulletin board systems. If you like, I will be happy to send it to you, on disk with the English manual, for the customary offer: Send a disk (either 5- or 3+-inch), a STAMPED SELF-ADDRESSED DISK MAILER, and $2 in US funds to the address at the top of this column, and I'll send you a copy by return mail.

If you'd like one of the modem kits, they are available from the BayCom authors as follows (note that prices are in deutsche marks; please check the conversion rate current for your area): program with instructions (state disk format), 20 DM; PCB only with construction manual, 12 DM; complete kit including TCM3105 modem, 89 DM; update kit for digital squelch, 10 DM; surface-mount modem kit, 94 DM. Send requests to: Rudi Dussmann, Kto 190786-859, Postgiro Office, Nuernberg, BLZ 76010085, Germany (and be *sure to mention 73 Amateur Radio Today*'s "RTTY Loop"!). My thanks to Crispino Messina I5XWW, for his help in making these programs available.

Three Treats from MFJ

As long as we're talking about packet this month, and given that much of packet is on VHF, let me take a minute more to tell you about three bargains available from our friends at MFJ. How many hams operate VHF packet by plugging the TNC or computer into a hand-held unit, and operating with the limitations of the rubber ducky antenna? Well, no more! For under twenty bucks you can have a fully functional antenna for 2 meters or higher bands. UNDER TWENTY BUCKS!

The MFJ-1750 5/8-wave 2 meter ground plane handles 300 watts, with SWR under 1.5:1 over the entire band. One U-bolt mounts the weatherproofed aluminum antenna to any mast, where it should perform beautifully for years.

For traveling, the MFJ-1730 pocket roll-up "J" 2 meter antenna will roll up into your pocket, and unroll to create a classic "J" antenna. This is an omnidirectional gain antenna which does not require a ground plane, perfect for hotel rooms and camping out.

The budget-conscious ham will be interested in the MFJ-1740 quarter-wave ground plane. Tunable to the 144 MHz, 220 MHz, or 440 MHz band, this represents an affordable way to put the station on the air.

Listing at $19.95 for the MFJ-1750, $14.95 for the MFJ-1730, and only $12.95 for the MFJ-1740, these are certainly affordable alternatives to some of the more expensive skyhooks out there. I might just put one up myself! Contact MFJ at (800) 647-1800 to order, or (601) 323-5869 for information, or write them at P.O. Box 494, Mississippi State MS 39762 for details. Be sure to tell them you read about it here, in RTTY Loop.

Until next month, keep those cards and letters coming; I enjoy every one of them. Mail them to the above address, or Email me on CompuServe (ppn 75036,2501), Delphi (username Marc-WA3AJR), or America OnLine (Marc-WA3AJR). We'll uncover more goodies for you next month, and you never know where I might turn them up. But you can find them here, in "RTTY Loop." 73

Table 1. Serial Port Requirements

Signal	25-pin	9-pin	Description
DTR	20	4	Send data ±10V
RTS	4	7	PTT, high-active, −10V = RCV, +10V = TRN
CTS	5	8	Receive data
GND	7	5	Ground

Number 24 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525-4438, 8 data bits, 0 parity, 1 stop bit. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: Manual and schematic for Hammarlund HQ-180AX general coverage receiver. I will pay for originals or copies. *Kelly Andrews KD4EWG, 8608 Timberwind Dr., Raleigh NC 27615. (919) 870-6923.*

Very tight budgeted ham is looking for FL-32 and FL-34 filters for the ICOM IC-720A transceiver. Also, a service manual for same. Please send fair price quote. Thank you. *Art Brigman, 243 Weiss St., Buffalo NY 14206.*

Disabled Army Veteran Ham (709th Ord Bn, 1958–60), living on Social Security Disability, would like to receive a donation of a complete station for HF bands, either CW or phone; preferably tube equipment in working order. Might be able to pay shipping retroactively. *Charles J. Bral N9KPL, 901 Maple Ave., Rm. 617, Evanston IL 60202.*

Wanted: Instruction book for the Micronata Dynamic Transistor Checker, catalog number 22-025. *Glenn Torres KB5AYO, Rt. 1 Box 580-B, Reserve LA 70084.*

Needed: Service manual or copy for: (1) Frequency meter 20-1000Mcs, Model FM-3 Serial No. 4035, made by Gertsch Products Inc., Los Angeles CA, USA. (2) Time Mark Generator, Model 180 A, Serial No. 010468, made by Tektronix Inc., Portland OR, USA. *Kerry Summerfield, 42 Juniper Rd., Mairangi Bay, Auckland 1310, New Zealand.* Phone and Fax *+64 (9) 479-5313.*

Needed: Schematic and manual for Conar Model 280 Signal Generator. Photocopy OK. *Dave Jorgenson N7OWT, 693 Darkwood Pl., Beavercreek OH 45430. (513) 429-3628 eves.*

The Club members of Larkana SW Listeners Club and Library are looking for those Hams, DX Clubs, Publishers, and Manufacturers, which are interested in donating technical books about Amateur Radio and QRP transceiver/receivers (10, 20, 40, 80 meters), to newcomers. We will pay postage. *AP2AHQ, President LRLC, H.No:1989/A.1 Shaikh St., Karma Bagh Larkana 77150, Sindh Pakistan.*

Wanted: Schematic diagram for Advanced Receiver Research converter Model R144VD. (144 MHz in/28 MHz out). Please let me know how many IRCs I should send you for photocopying and mailing. *Ron Gang 4X1MK, Kibbutz Urim, Negev MPO, 85530 Israel;* or via Packet *4X1MK @4Z4SV. ISR.MDLE.*

Re: KJ6DO–Did you ever work this call at Johnson Island? Any info about old QSL cards, operator's names, etc., would be greatly appreciated in my hunt for the history of my call. *Dr. Chuck Bowers KJ6DO, 837 Ridgeview Ct., Oakdale CA 95361.*

Number 25 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Build Your Own QRP Transmitter

What's been your excuse for not trying QRP? Don't have the time to build a small transmitter? Can't find the parts for your project? Perhaps you've never built a QRP transmitter and don't have the test equipment to trouble-shoot the transmitter if it fails to operate.

Well, have I got a project for you this month! It's a small crystal-controlled transmitter, already built and ready to go. Add a crystal, key and power supply and you're on the air with up to 2.5 watts of RF. The power output is determined by the operating voltage of the unit. The transmitter will provide a nominal 1.75 watts at 14 volts or 1.25 watts at 12 volts.

The transmitter is the SW-1 medium/shortwave CW exciter/transmitter produced by Rayan Communications in Harmony, PA. The SW-1 is sold by Fair Radio Sales, 1016 East Eureka Street, Lima, OH 45802, a company whose 44 years in business has been largely with war surplus electronics. When someone mentions Fair Radio Sales, visions of ARC-5s and RT-77/GRC-9 transceivers come to mind. Of course, Fair Radio Sales also sells other electronic surplus aside from RT-77s.

Depending on the band, the price of the SW-1 ranges from $29.95 to $32.94. Fair Radio has a special for an order of four SW-1 exciters on four different bands. The frequency range of the SW-1 exciter ranges from 1.8–2.0 MHz, 3.5–4 MHz, 7.0–7.3 MHz, 10.1–10.5 MHz, 14.0–14.35 MHz, 18.068–18.168 MHz, 21.0–21.45 MHz and 24.89–24.99 MHz. A different SW-1 exciter is required for each different band because of the filter network used on the board. I ordered an SW-1 for the 30 meter (10.1–10.15 MHz) band.

There are three active devices in the SW-1. A single 2N3019 makes up the power amplifier. There is no high SWR protection diode in the PA circuit, so an SWR of under 2:1 would be a good idea to ensure a long life of the PA transistor. A single 2N4124 for the crystal oscillator and a 2N5089 for the buffer driver share the 4" x 2" commercial grade G-10 PC board. The entire PC board, less the crystal, weighs two ounces.

The SW-1 on 30 meters produced 1.5 watts at 13.8 volts, according to my MFJ QRP wattmeter. Hey, it's no Bird Thruline™, but it has been right on the money—most of the time. The power of the SW-1 is rated in ICAS, or Intermittent Commercial and Amateur Service. At 12 volts the SW-1 will produce 1.75 watts ICAS or 1.25 watts CCS (Continuous Commercial Service.) Key down and the SW-1 PA gets right hot to the touch. I'd keep the supply voltage down under 14 volts so the PA won't go out to lunch—permanently.

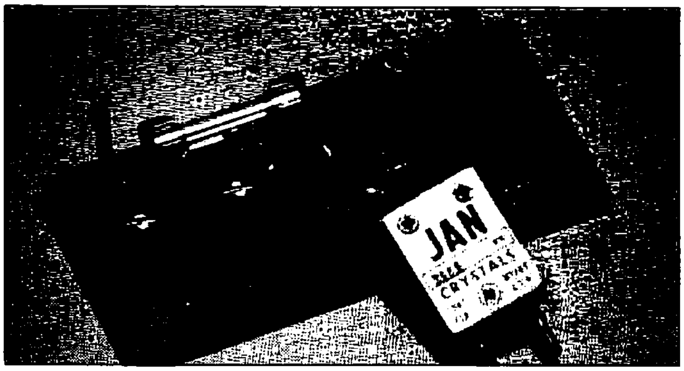


Photo A. The SW-1 QRP transmitter.

Features

Kinda strange to me, and I'm sure to a lot of other QRP builders, is the on-board fast-acting fuse. It's a 3/4 amp fuse to protect the entire SW-1. A diode on the board will conduct, blowing the fuse, if you connect the SW-1 up to the power supply backwards. It's a nice touch, especially for those shorts between the headphones when we hook something up backwards. Personally, I've never done that—really!

Frequency control for the SW-1 has provisions for fundamental mode HC6/U or HC33/U quartz crystals for non-oven, direct circuit board mounting. I have not used the popular FT-243 crystals on the SW-1. I see no trouble in using FT-243 crystals in the SW-1 as the oscillator is quite simple. Just about anything should oscillate in that circuit. It might prove interesting to rework this oscillator into a buffer/amplifier stage and add an external VXO or VFO for frequency control of the SW-1.

When I opened the box from Fair Radio containing the SW-1, I was immediately taken back by the apparent "mil spec" construction of the SW-1. Most of the resistors on the board are 1/2 watt, instead of the usual 1/4 watt resistors used by most of us. The PA transistor has a finned heat sink already attached to it. A big glob of heat-sink transfer compound can be clearly seen on the PA transistor and its heat sink. All the tuned circuits are wound on toroids and the toroids are in turn mounted to the PC board with 6-32 screws and fiber washers. Flip the PC board over, and there between the crystal's socket is a surface-mount resistor.

The circuit of the SW-1 is a bit out of the ordinary, compared to many QRP transmitters you might have seen before. The oscillator's supply voltage is regulated via a 10 volt zener diode. To key the SW-1, you ground the emitter of the 2N4124. You don't see this too often. Not that it's bad, it's just different. You might have some trouble with the keying if you use a keying device utilizing a transistor. These transistor switches don't pull the key line all the way to ground because of the 0.7 volt junction of the transistor. Because the key line can carry some low-level RF, keep the wires short from the SW-1 to the keying device. For the SW-1, use a reed relay (driven by your keyer) or dig out your straight key or bug! If you built the universal T/R controller last year, that unit provides solid ground keying via its built-in reed relay.

The PA transistor has two resistors in the emitter lead. Two resistors are used to reduce the current flowing through each resistor and to reduce the overall resistance. This is different, as most QRP transmitters have the emitter lead connected directly to ground. Again, like I said before, this is different, but not necessarily bad.

So, how does it work? Great! Plug in the crystal, power and key, add an antenna, and you're off and running. I find the keying just a bit soft, but it might be my crystal. In the SW-1, you're keying the oscillator on and off. Many contacts were produced on 30 meters with the SW-1.

The Instructions

The instructions that come with the SW-1, and there are three double-sided pages, caution you not to solder any conductors to the terminal post or to the circuit board conductor traces. Doing this will void all warranties associated with the product. Trouble is, there is no mention of the warranty. I tried to call Rayan Communications, but was told the number has been disconnected.

A small plastic bag of connectors for the PC board quick-disconnect terminals are supplied so you don't need to do any soldering on the board.

If you've never done much building, the instructions may give you a fright! They read like a military manual. For example, the following caution: "Under no circumstances should an external voltage potential be applied to the exciter/transmitter keying terminals. Connections to the keying circuit originating from input/output (I/O) modules of computer devices and/or process controllers should be checked for this condition." Whoa!!

So, what's it mean? Well, just don't apply any voltage to the key line.

My favorite from the manual: "The user must supply static discharge and/or lightning protection apparatus if an antenna system is connected to the exciter/transmitter module." Simply don't hook up the SW-1 to an antenna during an electrical storm.

Besides the obvious benefits of using the SW-1 for a transmitter, you could use it as a low level driver for a transverter. How about a BFO? A beacon transmitter for 10 meters (some changes would have to be made). A plasma generator for thin film solar cell production? The list is endless.

So, now you have no excuse for not trying out QRP. The SW-1 is a fast and inexpensive way to get your feet wet in the fun of QRP. Give it a try, the results will amaze you!

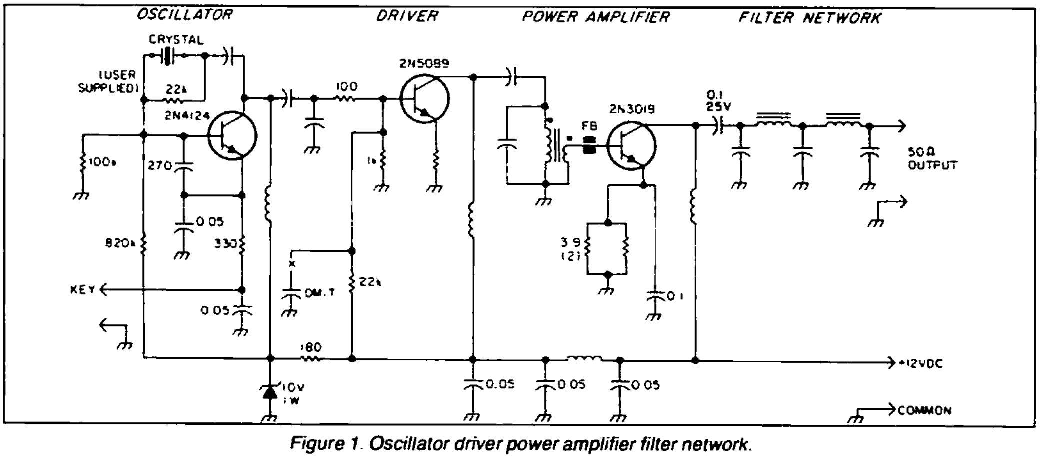


Figure 1. Oscillator driver power amplifier filter network.

Number 26 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

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Microwave Considerations for Resistors and Capacitors

This month, let's cover resistors and capacitors as they relate to microwave construction. This topic is in direct relationship to the PUFF microwave design program I described last month. Special components are required for microwave construction so I thought that covering some of those considerations would be a good topic for you while you wait for your PUFF program to arrive. The selection rules are general and can be used in most construction for VHF through microwave.

Selecting a proper component can not only provide proper operation at higher frequencies, but it can also prevent poor performance in a project. Components should not be selected for value, but for *type* of component. Construction and case style are important factors to consider. You must consider mechanical and electrical parameters as they affect the circuit at a rated frequency. Failure to observe proper component selection could lead to project failure.

Choose Your Components Carefully

Being a parts junkie, I collect component parts in quantity from many different surplus sources. The variety of components I see run from Mil-Spec high tolerance devices to garden variety resistors and capacitors. Using junk parts is cost effective.

In retrospect, one project comes to mind that I had difficulty with—it would not function at first. What I constructed was a 70 MHz IF amplifier, eight stages with log output for a spectrum analyzer. It was supposed to have 90 dB of gain at 70 MHz, but in testing, all stages were very numb. Total gain with full tune-up was about 25 dB. Well, to make a long story short, I traced the trouble to the high precision resistors I used—1% high quality Mil-Spec resistors. They were inductive wirewound types, and operated like RFCs (RF chokes). Replacing them with junk box carbon 1/4 watt types solved the problem.

For low frequency work the 1% resistors were spectacular, but at RF they were the pits. I should have known better. Now when I obtain surplus components I refer to catalogs to determine their suitability and mark that on the envelope that I store them in. In this case I was careless and did not heed my own advice, and it bit me. Don't get bitten. Obtain a general catalog and keep it on hand. Two very good parts suppliers are Allied Electronics and Mouser Electronics (addresses below). Both are good sources for information/catalogs, in addition to supplying components for your projects.

Resistors

Resistor lead length can also be critical. In some circuits this can be put to use in either a positive or negative way. For example, let's assume a resistor lead length of 1/2", at a frequency of 30 MHz. That equates to such a small inductance at 30 MHz that it can be totally ignored (0.006 µH or so). However, at microwave frequencies this lead length would represent quite a bit of inductance and function as an RF choke, a negative example.

The exception, where a resistor lead length forms an RF choke and is useful, is in an MMIC amplifier circuit where the long resistor lead length is coiled into a very effective RFC, and feeds DC power to the amplifier, isolating it. This DC feed resistor and lumped RFC provides good isolation to the power supply and uses one component. This provides for an inexpensive solution and circuit simplicity. This is one example of a device's long leads working for you in a positive way. It works well because the resistor and lead length RFC form a circuit in shunt with the device. If it had been in series with the device, it would have shut down the circuit operation.

Removing the leads on resistors, and changing the package style, resulted in a chip resistor. A resistor without the inductance associated with leads is suitable for very high frequency work. A chip resistor is constructed by placing a deposited carbon film on one side of a ceramic chip. Solder caps are provided for connections. These chips are well suited to strip line construction. You can buy a basic assortment of chip resistors (200 pieces) at Radio Shack for under $6, part #271-313. (See Figure 1.)

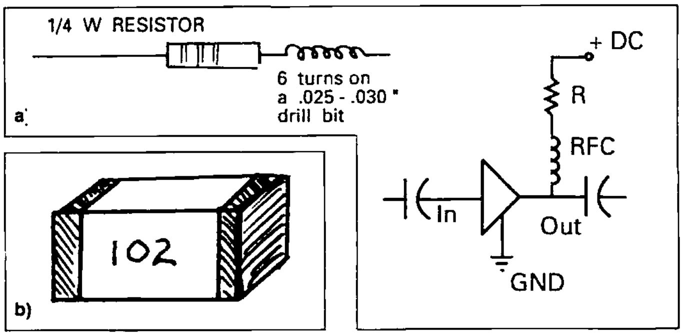


Figure 1. Standard and chip-type resistors. (a) MMIC Amplifier: You could combine the resistor and RFC by winding small RFC out of the resistor lead on one end. (b) Chip resistors are very small and are usable for microwave, within reason. Radio Shack's assortment has the value printed on the resistor. Examples: 102 = 10 + 2 zeros = 1,000Ω; 103 = 10 + 3 zeroes = 10,000Ω; 100 = 10 + 0 zeroes = 10Ω.

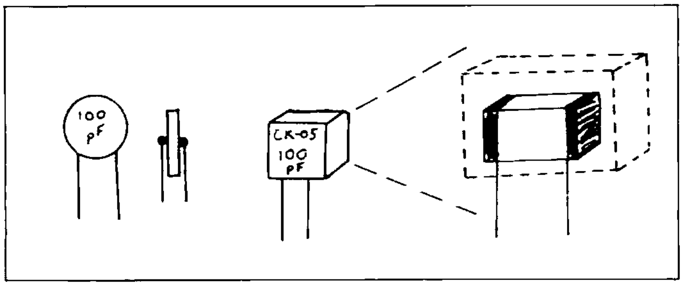


Figure 2. Ceramic capacitors. (a) Disc ceramic. The basic construction is a circular wafer with metalization on each side, forming the capacitor. Wire leads are soldered to the metalization. Sizes vary from 1/8" to larger. (b) CK-05 ceramic capacitor IS chip with packaged leads soldered to the side of the chip. The chip can be recovered by cracking the epoxy case and unsoldering the wire leads, making a lower inductance capacitor. The chip is approximately 0.15" x 0.15" square. Both the disc ceramic and CK-05 capacitors are good to 1 GHz and display lumped resistance and inductance degrading UHF operation.

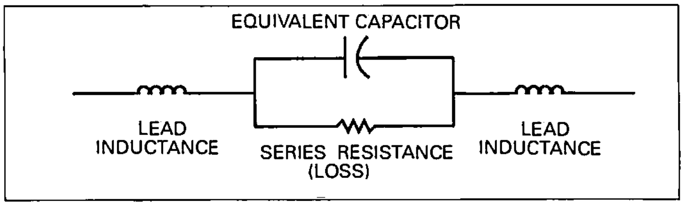


Figure 2(c). A typical capacitor at 1–2 GHz.

Basic Capacitors

Some of the more common types encountered are the poly, mylar, or mica and metal film types. Of these capacitor types, only the mica is suited for RF to the VHF/UHF frequency ranges. The disc ceramic and encapsulated chip types with leads (such as the CK-05) use a plated ceramic material to form the capacitor. They are quite good to 1,000 MHz. (See Figure 2.) At frequencies above 2,000 MHz, connecting leads on capacitors renders them ineffective, and other methods must be employed. The next generation of capacitor improvement at higher RF dictated a capacitor without leads. The uncased ceramic or early chip is an example of leadless capacitors. (See Figure 3.)

This leadless or chip capacitor can be a multi-layered high quality, high Q device. Values range from the small pF ranges for microwave capacitors (0.2 to 30 pF or so). Chip capacitors can be supplied even in the µF ranges. Of course, they are not suitable for microwave work—only the very low pF ranges are used at RF. The RF bypass capacitor is the exception. Other available chip type components include inductors, fuses, diodes transistors and about anything else you care to mention. Most components are made for low frequency work to reduce circuit size, and some are usable at the microwave level.

You must get into catalogs to make determinations on component suitability. I suspect that most of these components offered today, including surface-mount (chip) components obtained from scrap PC boards, are quite useful into the several hundred MHz ranges. With trial testing, this frequency generalization can be extended. On unknown components, testing through use is the only sure method to determine suitability at the microwave level.

Several manufacturers' advertisements list the cost of microwave components as several factors higher in price than their low-frequency counterparts. Unfortunately, this is very true; microwave components are costly. An example can be made for not using cheaper chip caps instead of microwave varieties. One manufacturer depicts a microwave amplifier that has blown out. The power FET blew out, due to an overrated, cheap chip capacitor. The advertiser ridicules saving a dollar by buying a cheaper capacitor when you will end up having to replace that capacitor *plus* the expensive FET, at premium dollars. Net result: No savings at all.

Their claim, a very valid one, is that the device would not have been destroyed if the circuit designer had used a capacitor rated for low dissipation, low loss, at the frequency used. Circuit losses of several dBs are possible with low frequency components used in microwave frequencies. The circuits will work with low frequency components, but do not realize their full capability. I have observed capacitors so hot from circulating RF current that they squirm in a sea of molten solder that previous-

ly attached (soldered) them to the PC board.

I don't want to appear to be really tightly postured on component use, as there is no real right answer. Lots of substitutions can be made with good results. You just have to keep in mind what is happening to the component. Is RF passing through the component, or are you trying to bypass RF?

For RF coupling, the disc ceramic is very effective for low MHz to several hundred MHz operation. At the 500 to 1,000 MHz frequency range, a capacitor's lead length becomes a limiting factor in its use. Disc ceramic types can still be used, but their connecting leads must be kept to an absolute minimum for the capacitor to be effective. With long leads, the capacitor might as well not be used as its inductance (in the leads) could render it useless.

These considerations are not important below 30 MHz, as component size is a fraction of a wavelength (100 inches equals 1/4 wavelength at 30 MHz). However, at 5 GHz a 1/4 wavelength is quite small in respect to the component, so it deserves consideration. At 10 GHz, component size is twice as critical. At 24 GHz, soldering methods used to attach components can form RF notch filters in the solder connection if the component is not fully soldered to the PC board substrate in a fully-soldered trace. The gaps or bridges in partial solder can cause real trouble.

In an amplifier we constructed with MGF-1402 for 10 GHz, we had trouble obtaining gain at 10 GHz. We solved the problem by mounting the FET upside down. This made for much shorter source leads to ground, several thousandth's of an inch made the difference. Here again minimum inductance allowed the circuit to function.

These same inductance and circuit losses make other components unsuitable for higher frequency use. Package inductance and equivalent series resistance (ESR) make higher losses to increasing frequency. If you look at the frequency ratings and Q of capacitors, you find them rated at frequencies of 1 kHz and a few MHz. Q is quite high, but when measured at higher frequencies this is another matter. The construction of the capacitor plates adds inductance; resistance is formed and the IR and dielectric losses are different at increasing frequency.

Disc capacitors are usable at very high RF frequencies and were an early VHF/UHF type. They were shipped uncased, without connecting wire leads. These uncased disc capacitors resembled a wafer with a small deposited metallic contact on either side of the device. They were attached to the circuit directly, without connecting leads.

This technique is OK to about 2 GHz; higher frequencies dictate still different methods. Remove the coating on standard disc capacitors and you can unsolder the wires and have uncased caps. Be careful—they are very fragile.

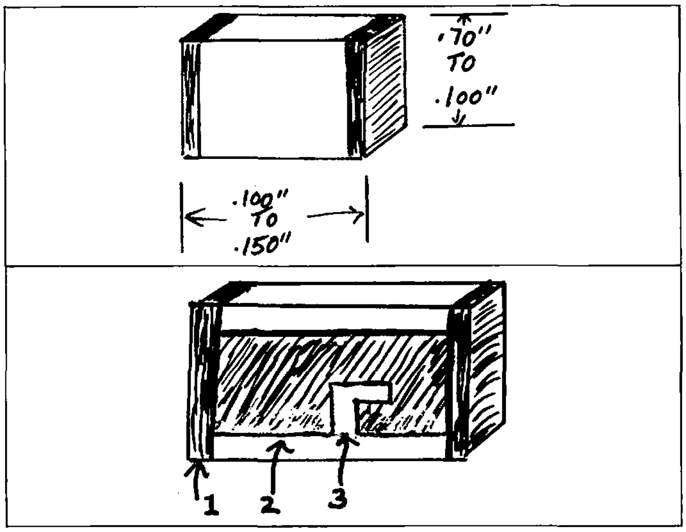


Figure 3. Surface mount device (SMD) chip capacitors and resistors. (a) Solder the capacitors on each end of the ceramic substrate. A lower Q at microwave levels produces a higher loss. This chip is usable to several GHz. The loss becomes unacceptable at 5 GHz. The normal stock value comes in large steps (2.2 pF–10 pF–47 pF, etc.) The value/size ratio is too large for most microwave projects. (b) First, solder the capacitors to each end of the ceramic substrate. Put film-deposited resistance material where indicated. Precision-trim the film, by laser cutting, to the test value. Under normal use, this model is good to 10 GHz for bias and voltage feeds in amplifiers.

Microwave Chip Capacitors

The need for lower inductance in capacitors for microwave frequencies has led to the development of chip capacitors of superior construction. They are different from surface mount capacitors (a form of chip cap), which are not suitable for use at microwave frequencies. Non-microwave capacitors are basically rectangular, unlike their microwave counterparts.

The microwave chip capacitor is packaged in a 50- and 100-mil-square package to be compatible with strip line connections. It would not be acceptable to place a capacitor wider than a strip line on that strip line. It would upset the impedance of the circuit and increase loss. Most connec-

tions are made with 50 ohm strip-lines, such as amplifier input and outputs connected to coaxial connectors (50 ohm). Make the capacitors the same dimension, 0.050-inch-square, so that they match the strip line width well. Their porcelain insulation will provide lower losses to RF currents.

This porcelain substrate that forms the ceramic insulating structure is more expensive than your basic ceramic and is one of the prime reasons the capacitor will perform at microwave frequencies. ATC (American Technical Ceramics) makes the capacitors that are rated for microwave work. They are the ATC-100 style of chip caps. They have precious metal electrodes and low-loss porcelain to make microwave RF circuits work better.

A circuit tested at 500 MHz attained a 1.4 dB noise figure with a device rated at a 1.2 dB noise figure, demonstrating the capacitors' part in helping to give low loss characteristics. Any loss is directly added to the basic noise figure and degrades it. The lower losses can be put to real advantage, whether you are reaching for the ultimate or just looking for improvements in your basic system.

It has been reported that other types of chip capacitors used in amplifier circuits have not produced proper gain and noise figure measurements. Improvements of 1 to 2 dB have been attained when switching to the low loss ATC-100 type capacitors at microwave frequencies. See Figure 4 for details about ATC-100 capacitors.

Our 10 GHz amplifier ATC-100 caps of 1 to 2 pF were used to couple the coaxial connectors to the amplifier and interstage coupling. By the way, a 0.9 pF capacitor is self-resonant at 10 GHz, 2.5 pF is self-resonant at 5.6 GHz, and 20 pF is resonant at 2.3 GHz. There are two schools of thought: (1) Use a self-resonant capacitor for frequency of design; and (2) Use a 10 pF capacitor and don't worry about self-resonance. Both seem to work well.

Standard chip caps, of surface mount type, can be used for the power supply bypass connections (100 pF to 0.001 µF or so). They do not have to be the low-loss RF types as we want them to bypass RF to ground. These are what we call surface mount devices (SMD). They are very good capacitors but they're just not rated for microwave stripline work at microwave frequencies. Basic ceramic SMD capacitors, while high Q devices when used in high current applications, can fail due to greater losses and over-dissipating in RF circuits.

The dielectric constants of the materials being used for microwave capacitors give smaller capacitor size for unit value. This reduces the inductance and equivalent resistance, making a higher "Q" device with less RF loss. This drives up product cost over the basic SMD ceramic chip capacitor quite a bit, but performance is markedly improved in the microwave region.

ATC makes several lines of excellent microwave chip capacitors that are a standard of excellence in construction, if not top-of-the-line. I have used SMD capacitors up to 4 to 5 GHz, but I always question their application. If in doubt, go for the better capacitor. The bottom line is how well you want your circuit to function.

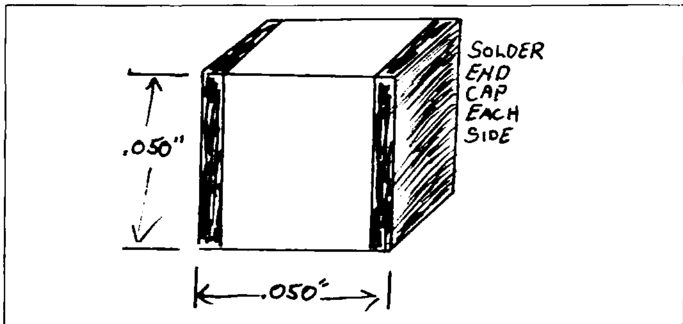


Figure 4. Standard microwave chip capacitor. This type usually comes 0.050" square for 5 and 10 GHz projects. The low loss ceramic porcelain material is rated for microwave use (low ESR—Equivalent Series Resistance. The case dimensions are well matched to microwave 50Ω strip line widths. These capacitors are supplied in very small fractional pF ranges: 0–1 pF, and higher values normally 0–30 pF. Examples: ATC-100 from American Technical Ceramics; S-910 from Johanson; and MA-18 from Murata/Erie.

The Manufacturers

Allied Electronics Administrative offices are at 4801 N Ravenswood Ave., Chicago IL 60640-4496; telephone: (312) 748-5100. They have distributors in most states, and in most provinces in Canada. Mouser Electronics is located at 11433 Woodside Ave., Santee CA 92071; telephone: (619) 449-2222. Their national number is (800) 346-6873. Mouser also offers full-line services to all of the U.S. and Canada. I have ordered from them and have had the order delivered the next day. They are very prompt. Both of these companies have catalogs available, low minimum orders, and a very good stock of components on hand.

Next month, when your copy of PUFF arrives, I will get into some considerations using PUFF. I will cover some of the problems Kerry and I ran into, and a short overview of PUFF.

Well, that's it for this month. As always, I will be glad to answer questions regarding this and other related topics. For a prompt answer, send an SASE. 73, Chuck WB6IGP.

ASK KABOOM

The Tech Answer Man

Michael Geier KB1UM
c/o 73 Magazine
Forest Rd.
Hancock NH 03449

Receivers

Let's wrap up our discussion of receivers and then look at a few letters.

We've seen how a signal progresses from the antenna to the speaker in a superheterodyne receiver. The IF-based scheme gives us lots of selectivity, and we can get plenty of sensitivity at the RF input, or "front-end" stage, so we're all done, right? Well, almost.

AGC

One of the annoying things about radio signals, especially those which have traveled thousands of miles and been bent around by the ionosphere, is that they fade in and out. This fading causes unpleasant volume changes, which can range from bare audibility to receiver overload, in the recovered signal, and it is very desirable to attempt to compensate for it right in the radio. But when we are receiving AM or SSB, the amplitude of the signal is what carries the intelligence we want to recover, so how can we tell the difference between changes in amplitude caused by modulation and those caused by atmospheric distortions?

Turns out it's fairly easy. Luckily, fading happens much, much slower than modulation, so we can simply pick off some of the IF signal, rectify it and then low-pass filter it to remove the modulation. If we're really smart, we sample the signal after the ceramic filter, so that signals near our listening frequency but not within the filter's passband will not affect the AGC.

What's left will be a varying DC voltage corresponding to the average level of the incoming signal. At least it works that way for AM, which has a constant carrier. For SSB, you get a varying DC voltage corresponding to the voice level, because essentially there is no signal between syllables. Either way, the speed at which the voltage can change is governed by the low-pass filter. The bigger the filter capacitor, the slower the changes which can result. It's no different than the effect of capacitive filtering in a power supply; bigger cap, less hum. Really big cap, smooth DC, right?

OK, so now we've got this varying DC voltage. What do we do with it? We use it to control the gain of the front end or the early IF stages, that's what! If the signal gets too strong, we clamp the gain of those stages down and bring it back to a reasonable size. If it gets too weak, we open 'em up wide and build it up as much as we can.

If your rig has a fast/slow AGC control, it lets you select the size of the AGC filter, or *time constant*. A short time constant is great for CW, because unwanted signals in the passband, or static, will not clamp the gain down and cause you to miss any dits or dahs. For SSB, though, such a fast-acting AGC will make the voice sound choppy and echoey, so a slower time constant is in order. Most SSB AGC circuits are designed to respond to voice peaks, which simply means that the filter capacitor is made to charge faster than it discharges. The result is that the receiver's gain follows loud speech elements quickly, without "pumping" like a too-fast AGC. This makes for the most pleasing, natural sound. A good AGC circuit which responds properly causes the radio to reproduce quality speech. A poor one can exhibit "overshoot" by not catching voice peaks in time. (Really, they ought to call it "undershoot"!) Such a bad circuit will make the radio sound "peaky" and distorted on the louder speech sounds.

> ***"OK, so now we've got this varying DC voltage. What do we do with it?"***

Even AGC has its limits. A good one might correct an 80-decibel signal change to within 6 dB or so. To get an idea of how much better that is, try turning your AGC completely off if your rig lets you do that. I promise you, you won't be able to listen to it for more than a few seconds. AGC is vital to good receiver performance.

Spreading It Around

As with any other device, different designers have various ways of implementing the basic superhet concept. Sure, all superhets have a front end, a mixer, one or more IF chains and a detector. But consider this: Each stage contributes in some way to the overall sensitivity of the radio. Might there be some optimum way to distribute the amounts of gain? What do we have to gain (OK, a little pun intended) by worrying about this?

If we put most of our receiver's gain in one or two stages, we are asking those overworked areas to have quite a bit of dynamic range. Dynamic range is the difference in strength between the smallest signal the radio can hear and the biggest one it can handle before overload. The figure is expressed in decibels, and the bigger the number the better.

Since the objective is good overall dynamic range from antenna to speaker, it pays to spread the job around a bit. Especially in the front end RF amp, it is not practical to have barrelsful of gain *and* high resistance to overload, even with AGC. The solution is to limit the gain of the amp and make up for it in the IF stages. Even the audio amp can be used to advantage here; the more audio gain you have, the less signal you need to drive the speaker in the first place.

So why have an RF amp at all? In fact, some receivers omit it! It takes very careful mixer and IF design, though, to get enough gain without one, particularly at the higher frequencies where mixer losses and stray capacitances can wipe much of the desired signal out before it ever gets to the IF stages. In particular, passive diode mixers work poorly without an RF amp, because the voltage drop across the diodes causes you to lose small signals.

Dynamic range figures for good modern receivers can range from about 85 dB to 115 dB. Consider this: A compact disc player has about a 90 dB dynamic range. Our radios aren't doing too badly at all!

Phase It In

If you've been following the articles for the past few years, you've read about phase noise. What the heck is that?

As with any other circuit, an oscillator is not perfect. Along with its signal, it generates some noise. Some of that is in the form of amplitude noise, which can be thought of kind of like tape hiss in an audio recorder. Another type of noise is "phase" noise, which basically is random FM. In other words, the precise frequency of the oscillator wobbles just a little bit.

In a crystal oscillator, phase noise is very small, because the crystal is very steeply resonant. It forces the frequency to remain pretty constant. In an LC oscillator, the noise is still pretty small, again because of the high Q of the tank circuit.

In a synthesized design, though, the oscillator runs free with a low Q and its frequency is constantly being corrected by the synthesizer's digital circuitry. In order for it to be able to steer the oscillator, there has to be some error! The result is that the oscillator wobbles around its frequency. Careful design can reduce the wobbles to a very low level, but they are never as low as with a high-Q oscillator.

Open Wide...

The result of phase noise is that the receiver's passband appears wider than it actually is, because the oscillators used for mixing are moving around a little. It's almost as if you were wiggling the tuning knob around very fast. As a result, signals which shouldn't be in the passband get heard. Also, there's a "hissy" effect which garbles the audio a bit. Many of today's synthesized rigs suffer to some degree from this, but great strides are being made to eliminate the problem. The direct digital synthesis approach, in which the sine waves are digitally generated, greatly reduces phase noise, because there no longer is an analog oscillator which is constantly being corrected. I expect that we will see this system used more and more.

Well, I think that about wraps up the receiver topic. Now, let's look at those letters:

Dear Kaboom,

I need some kind of wideband power amp for RF. It doesn't have to have more than 1 watt of output, but a preamp won't do, and the commercial units cost too much. Are there any simple power amps around?

Signed,
Gettin' Stronger

Dear Stronger,

Sure! Power FETs make lovely RF power amps and will work to a few watts or more. Of course, things get tricky up at VHF, but for HF they are great. Lots of QRP rigs have been published in this magazine and others. For a simple amp which might help, take a look at my "Cassette Box Special," which appeared in the April 1990 issue of *73 Amateur Radio*. That one includes a simple driver and it might do the trick. It's cheap enough that you can try it and discard it if it doesn't work for you. Good luck!

Dear Kaboom,

Why do rigs with transistor finals have no loading controls like tube units? Seems to me the manufacturers are making lots of dough off of SWR bridges and tuners by omitting the built-in matching networks. Are we getting ripped off or what?

Signed,
Tuner Up

Dear Tuner,

No, I don't think so. The high-impedance characteristic of tubes made a pi network mandatory and, because it wasn't practical to make one which wasn't frequency sensitive, the controls had to be there. Transistors, though, are rather low impedance, so a simple wideband transformer will get you to 50 ohms without the frequency-specific problems. In fact, some early transistor units did have loading controls, and I suppose they could match a wider SWR range. But I think most of us prefer not to have to twiddle knobs every time we change frequency and the modern approach makes things simple, at least as long as you have a matched antenna. And, of course, we do have automatic matching networks today—they're called autotuners!

73 and see you all next month. 73

Never Say Die

Continued from page 4

You also know that the worries over the greenhouse eftect and so on are being re-evaluated. Global warming? Perhaps, but more due to sun spots than anything we're doing.

We do need activists, but we need educated activists, not religious fanatics and slogan shouters.

We know now that it isn't Japan that's causing our miseries. If you read much you know that foreigners own far less of America today than they did in 1914. You know that much of the Japan-bashing that's going on is dishonest and politically motivated. You also know that when it comes to protectionism, we have a terrible record which we'd rather not have mentioned.

In my report to the NH EDC I've outlined the major problems which have resulted in New Hampshire being the hardest hit of all the states by the recession. Then I've proposed 29 initiatives to get the state going again. The whole report is about 250 pages long. I'll eventually have it available in book form in case you'd like to read it . . . or perhaps send a copy to someone in your state government to give them some ideas on how to revive their economy. If you have any say in your local library buying, this would be a good addition.

The agricultural revolution is long past. Now the industrial revolution is fading, too, being replaced by the information revolution. Today it's what you know and what skills you have that count the most. It's not how hard you work, but how smart. Hard doesn't hurt, but without smart it's paying off less and less.

So what can you do to help generate thousands of new hams every year in your stale? Are you going to wait around for a parade to get started and join it? Or are you going to start the parade? I guess It all depends on whether you are a doer or a watcher. I never was much of a watcher. I can't even sit and watch ball games.

Ignoring The Problem

Is the loss of every past reason for amateur radio to be allocated hundreds of billions of dollars in precious bands a problem we can ignore and have it go away? Is this a problem we can refuse to face? We can hide from? Can we plead ignorance? In my experience people either keep up with progress or get buried by it. Well, technology has passed us by, so we either have to start preparing ourselves for our burial or we have to come up with a valid new reason for the hobby . . . one that will hold water when we're asked if we're repaying our country for our bands.

I believe we can reinvent the hobby and that without it America (and the rest of the world, for that matter) will have a much more difficult time coping with modern technologies. Electronic, communication and computer technologies are moving ahead faster and faster, so the longer we wait to start giving our kids a head start with amateur radio, the longer it's going to take for America to catch up with Japan and Europe.

If you have any other ideas for reinventing amateur radio, we need all the arguments we can muster. You know what new communications technologies are being developed and you have a darned good idea of how much bandwidth they're going to require, so you understand the urgency.

I'm doing what I can up here in New Hampshire. What are you doing in your state? Are you kerchunking repeaters and watching basketball games on TV? What'll it take to get you into action?

Can America Do It?

How difficult would it be, if we really wanted, for us to regain our lost consumer electronics industries? Or should we even bother, considering the enormous obstacles involved? And what 'n hell has this to do with amateur radio? If "hell" offends you, please substitute "dad blamed," or take a short walk on almost any New York street and get desensitized.

"I'm doing what I can up here in New Hampshire. What are you doing in your state?"

I believe that it's not just possible for us to regain our consumer electronic industry, but that it's of critical importance. Further, as the leading hobby in the electronics field, I think we amateurs are in a far better position to do something about this than any other group.

Let's start with last things first . . . our ability as radio amateurs to do something. Since what few of the general public who have heard of amateur radio tend to view it as an enormously technical hobby which is eons beyond anything they could possible understand, why not trade on this ignorance? The altitude this gives us can be used as a platform from which to pontificate. As priests of the mysterious and unknown, they'll tend to believe us.

Sure, you know how little you actually know about radio and electronics. And I know how little you even want to know. I get your letters whining or canceling every time I publish an article requiring more than casual thought. But the general public doesn't know and if you do what I say, I won't tell them what humbugs many of us government-licensed amateurs really are. So pay attention.

Our Electronic Future

Unless you're still reading your 1938 *QST*s, you are aware on some level that high tech is the future. Heck, it's the present too, but it's only going to get higher in the future. I'm talking shirt pocket communicators with fax printout. I'm talking home theaters. I'm talking smart homes. I'm talking smart cars. I'm talking even smarter offices. I'm also talking hundreds of billions of dollars in manufacturing, sales and service.

We've not just let Japan drive away with most of our consumer electronics industries, we've helped them pack the trucks. We cut off our supply of engineers, technicians and scientists at the same time as electronic technology was exploding. We did this by discouraging kids from scientific careers and by cutting the math and science courses. We've also choked off tens of thousands of kids a year who used to pursue high-tech careers as a result of being excited by amateur radio in their teens.

As I've mentioned until the ARRL directors turn blue that before their Incentive Licensing rule change was proposed in 1963 80% of all newcomers to amateur radio were teenagers . . . and 80% of those went on to high-tech careers as a result. If this growth had continued on the same curve as from WWII we'd have well over three million more high-tech American workers available for R&D and we'd have nearly five million licensed hams instead of one-tenth that.

I hope you'll agree with me that we're going to need a high-tech educated work force if we're going to try and regain our electronics Industries. That isn't all we're going to need, obviously, but a work force is basic and no matter what else we do we're helpless if we don't have it.

I hope you'll also agree with me that there's a lot we amateurs can do to prime the pump and get America started toward creating this work force. No, it isn't going to be easy. We'll be up against entrenched teacher's unions and politicians who are being bribed by these unions to prevent change. We'll be up against apathy, ignorance, and vested interests. Are you ready to give it up as hopeless? Where's your dad blamed gumption?

Opportunities

With three major new consumer electronics technologies looming on the horizon and inevitably coming, we have a unique opportunity to get the edge we need to start rebuilding our consumer electronic industry.

What are the three new technologies? Heck, you know the answer . . . or should. One is digital audio broadcasting (DAB), the second is high definition TV (HDTV), and the third is the combining of computers with the above in what we're calling multi-media (MM).

Since more and more of our electronic circuits are being handled on integrated circuit chips and less with discrete parts, the loss of our parts manufacturing plants is getting to be less and less of a problem.

I worried when our resistor, capacitor and transformer companies closed down as electronic manufacturing moved to Japan and Taiwan. Today we're doing more and more of the signal processing with chips and less with parts. We still need power supplies and power output circuits, but the parts count is far down from the past.

While we managed to lose most of our memory chip manufacturing, we're still hanging in there with microprocessors and special design chips, so we're actually in a good position to start building DAB and HDTV equipment here.

Being new technologies, there's an opportunity for small entrepreneurial companies to get into this field and grow . . . much like Apple did in the computer field.

Since these new technologies are wide open for experimentation, we amateurs have a golden opportunity to repay our country for the hundreds of billions of dollars in radio frequencies they're letting us use. If we don't start repayment there's an increasing chance the FCC will present a balloon payment bill and put us into bankruptcy. I'm talking Chapter 7, not 11, with our assets being auctioned off to the highest bidders. How much will your station be worth then?

Look, there wouldn't be cellular telephones today if we hadn't pioneered repeaters 20 years ago. So let's get busy and see what we can do with digital voice. Let's start working graphics into packet as a step toward multi-media. The next thing you know we'll be slugging full color video around in packets, complete with digital sound.

Old-timers will remember when we used to be called experimenters. These days we can build stuff with a few chips which would have taken several relay racks a few years ago. Well, if you'll build, I'll publish, and that'll inspire more people to build.

Yes, I know, I'll get lots of flak and subscription cancellations. Hey, I'm used to that. I lost tons of subscribers when I pushed repeaters 20 years ago. But I knew what I was doing was for the best interests of amateur radio, so I didn't let up.

Before that I pushed the heck out of sideband, again to the tune of a jeering crowd of AMers kvetching about Donald Duck radio. Oh, the static I got when I pushed solid-state circuits. Hams are tube people and always will be, said *QST*'s technical editor.

Well, it's time again to get our poor old brains into gear. If you'll experiment and write, I'll publish. The next thing you know we'll be seeing some new entrepreneurial companies

springing up like spring shoots with digital audio and multi-media products.

Of course, without an influx of youngsters into our hobby, we're not going to have many experimenters. Worse, even if we invent two or three new consumer electronic industries, we'll lose 'em without the engineers our new manufacturers will need for their R&D.

Getting Started

The no-code license has helped our growth enormously. While the FCC's lost count of how many hams are actually licensed, we do know that we had a growth of around 7.8% last year ... the biggest growth in decades. Oddly enough, even with the upsurge in Techs, the number of upgrades to higher licenses has dropped about two-thirds from 1990.

We know what we need to do if we want to have more growth. And we know that this will, in turn, result in more kids opting for high-tech careers. The main problem is getting into action. Well, that's the same kind of inertia we have to overcome if we're going to take off weight, get busy learning more, cut down on beer, take an interest in our own kid's education, and so on.

We need to get word of amateur radio into the local papers. We need to get kids interested in coming to our club meetings. We need to encourage them to start school clubs, even if we have to overcome objections from school authorities. We need to get our local TV reporters to do stories on our activities.

Like "Field of Dreams," if we build it, they will come. All you have to do is let kids know what fun they'll be able to have and, busy as they are, they'll be all over you wanting to know more. I'm very encouraged by the mail I've been getting. While there are still some old fogy ham clubs, more and more I'm getting letters and pictures from clubs who are bringing in kids and getting them licensed.

In some cases I'm seeing the old fogy clubs (and you know who you are) being bypassed and new clubs catering to youngsters being formed.

We have an opportunity right now to not only have a ball experimenting with some new communications technologies, we also have a golden opportunity for entrepreneurs to start some companies to supply parts and modules to help. I see a good chance for the "Apple" of the 1990s to get started.

Remember, it was just two kids that started Apple back in 1976, just a year-and-a-half after the first microcomputer was brought to the market. I still remember talking with Steve Wozniak and Steve Jobs in the garage of Jobs home in Cupertino, watching the prototype of the Apple I perform. Two youngsters.

Photo A. W2NSD in Aspen.

Photo B. The rest of the Aspen crew (left to right): KO1I, KV1J, K9MWM, W2NSD, NØDBY.

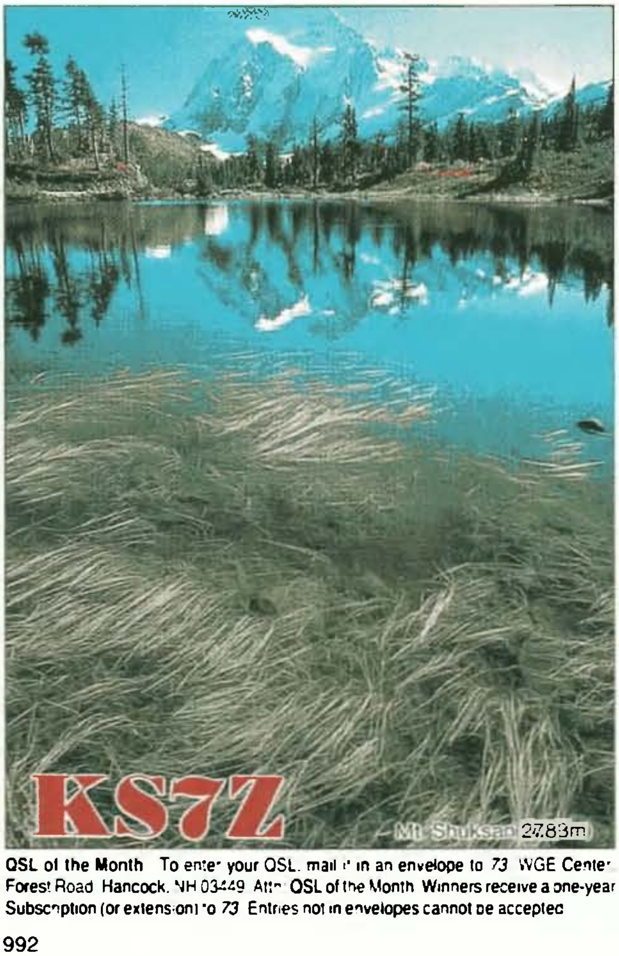
I also remember meeting Bill Gates back in 1975 when he'd just brought a cobbled-together BASIC interpreter to MITS to use with their Altair 8800 computer. Another youngster.

No, not everyone makes it, but no one does that doesn't try. It isn't luck that wins, it's working hard and working smart. It's taking advantage of opportunities. Well, you've got one whale of an opportunity looking at you right now. You know, there isn't anything all that mysterious about digital audio ... nothing that you couldn't learn in a few weeks, if you wanted.

Heck, I'm an old buzzard, yet I was able to cope with TV, and solid state when that came along. Then I had to get used to ICs. Next came computers and microprocessors. Now digital audio and I'm still game to learn. Bring on your compression algorithms and time domain.

Surely it must take a genius to cope with all this! Well perhaps, but only from Edison's concept of genius being 99% perspiration and 1% inspiration. It's work, but it's fun work. It's exciting work.

So what do you think? Can we do this or should we just resign ourselves to Chapter 7?



QSL of the Month. To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

Raise Hell

My report to the New Hampshire Economic Development Commission with suggestions for 29 initiatives to help get the state out of the recession is now available on the *73* BBS. If you have any gumption to get your state going, some of my ideas might just work in your state too. One reader in Alaska sent copies of my report to several city mayors and has set up a group to get started with some of my initiatives.

Of course if you are tired, or just don't have the time to do anything, never mind. But do remember the incredible power one person can have.

I'm sure you are terribly busy. So am I. But in spite of managing (to some degree) 31 businesses, including 10 publications, I squeezed in the time to write a 230-page book on how to get New Hampshire going again. Now tell me how you are too busy to help your state out of the recession. 73

73 INTERNATIONAL

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Notes from FN42

I have been truly enjoying myself the past several weeks before writing this. I have been assisting with the testing of a Bulletin Board System (BBS) for packet radio.

The operator of the BBS, Scott WA1YTW, inherited another operating BBS and computer after another ham, Alan W1FYR, decided that he could not continue to operate two BBSs at the same time because if he didn't make some time for himself and his family he would be by himself. Does that sound familiar? Anyway, continuing the story, Scott decided to change to a different BBS program but wished to keep the first system running until the second one was operating without bugs, to ensure a good transition.

You might think that this would be an easy task, considering that most of the BBS programs have been around for a while and all of the bugs have been worked out, but let me assure you that these programs are very intricate and you have to get things in just the right order or the program will crash and you can lose a lot of messages and traffic. We are very lucky to have another ham, Buzz WA1NHP, volunteer the use of his computer, his computer and radio knowledge, and his time to go through the associated hair-pulling and headaches to make this project the best it can be.

There is more to it than that. To allow the BBS to be used by many other hams, not just locals within simplex distance, it has to link into some sort of packet system, especially if it is located in what might be considered an RF hole. We are very lucky that within fair radio range of our BBS there is a node of the North East Digital Association (NEDA) packet network, SWNH: KA1BBG-1 (SWNH is short for South West New Hampshire). The gurus have been very helpful, especially Linds NR1N, in assisting in the proper parameter settings to make things work efficiently and properly.

This type of help and cooperation has occurred many times before this, in many different parts of our earth, by other hams volunteering their time and resources to make something good happen. I marvel at how I can enter a packet message in my packet Terminal Node Controller (TNC), have it picked up automatically by my Home BBS, and have it delivered automatically to its addressee, such as Ron Gang 4X1MK@4X4SV.ISR.EU in Israel, David Horsfall VK2KFU@VK2RWI.NSW.AUS.OC in Australia, or Milen Postadshieff LZ2MP@HB9AK.CHE.EU or LZ2MP@DKØMTV.DEU.EU in Bulgaria. Not only that, messages get back to my TNC automatically as well.

These things can only happen because of hams who care and are willing to make the effort.

One last thing before we move on: We must always remember that ham radio is involved in NON-COMMERCIAL subjects and activities. Some hams have gotten in trouble with the Federal Communications Commission (FCC) in the United States of America because they forgot or just didn't think! We must always be aware of what we are doing while using ham radio; we must make sure that we do not jeopardize our licenses. Even though I have packet capability, I have not publicized it in this column because the information I receive sent directly to me and used in this column might be construed as commercial since this magazine is in business to make money. So, if it's material related to this column, please send it to me in some other way. However, I would certainly love to make contact with other packet users around the world, if for no other reason than to demonstrate that packet works. Feel free to send a packet or two to me, but keep it non-commercial. 73, Arnie, N1BAC@WA1YTW.NH.USA.NA

AUSTRALIA

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The New Year has come and gone (at the time of my writing this), and there are some special celebrations this year, but more on that later. To follow on from my previous submission, there is no further information on a possible new grade of licence, the Code-less Novice, but I will advise as to what and when. By the time you read this, many amateurs (I hate the word "ham") will have returned from the Gosford Field Day, a veritable Mecca for enthusiasts. Whilst perhaps not up to the size of Dayton, nonetheless it's a busy affair, with disposal stalls, flea markets, lectures, demonstrations, equipment displays, etc. Is it my imagination that much of the "junk" finds its way to the various club auctions, thence back to Gosford? I'm sure there must be a "Law of Conservation of Junk" that holds here.

Some interesting developments are taking place in packet radio, with gateways being set up between the packet network and Internet, a worldwide computer network. The purpose is to provide a "worm-hole" for packet traffic, enabling faster distribution of mail and bulletins. Such gateways already exist in many parts of the world, and due to the efforts of a group affectionately known as the "packet underground," Australia is finally catching up. Amateurs are also being encouraged to "wean" themselves away from 1200 bps *[baud per second]* operation, and to try faster speeds such as 2400, 4800, and 9600 bps. The current "network" of 1200 bps ROSE *[RATS (Radio Amateur Telecommunications Society) Open System Environment]* links is starting to look somewhat dated.

As previously intimated, this is a year of celebration for Sydney stations. The City of Sydney is celebrating the 150th anniversary of its incorporation as a city, and also the establishment of local government in the State of New South Wales. During this Sesquicentenary, the special callsign of VI 150 SYD is in use by various stations, clubs, and individuals in NSW. (Note that VI is a special prefix, and is reserved for special events, along with the AX prefix occasionally heard. Generally, "AX" is used by individual amateurs instead of "VK," whereas "VI" is reserved for event stations). As many frequencies and modes as practical, from DC to Daylight, will be in use. A special QSL card is available, and QSLs and SWL reports may be sent via the Bureau to VK2 QSL Bureau, PO Box 73, Teralba, NSW 2284, Australia. Those wishing to QSL direct may send a stamped self-addressed envelope (6-1/4" x 4-1/4") to: WIA (NSW Division), PO Box 1066, Parramatta, NSW 2124, Australia, for the attention of "VI 150 SYD."

Another Special Event Station is V12RC, operated by Tony VK2DEJ, to celebrate the bicentenary of the settlement of the town of Ryde in NSW, and its recent incorporation as a city. This station has been active since the start of the year, and so far Tony has worked all continents and 33 countries. VI2RC will be active for the remainder of the year, on all bands from 160m to 70cm. Prefix-chasers should certainly have something to keep them occupied!

Finally, the WIA Broadcasts recently introduced Harry Angel VK4HA. Harry turned 100 years old on 14th December last, and has been licenced since 1935. He has achieved many distinctions in his life, being an active DXer, contester, experimenter, and lecturer. It is his face that graces the cover of *Amateur Radio*, December 1991. At a hundred years old, is Harry VK4HA the oldest living amateur in the world? (I'll bet not even Wayne is that old, HI!)

Cheers for now. Dave Horsfall VK2KFU

AZORES

Portugal

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Picking up from my last contribution, here is some more background on the Azores.

The Azores were discovered and settled by the Portuguese in the 1400s

Photo A. Sr. Manuel Valadao CU3CS (left rear) and adult leaders with some of the Terceira Scouts with their home-brew 15 and 20 meter dipole during JOTA, October 1991.

and 1500s. As an outpost of Portuguese power, by which it could protect lines of communication and serve as a stopover for supplies to the Portuguese vessels sailing the Atlantic, the Azores have played an important part in Portugal's history.

During World War II, the Azores became very important because of their geographic position between Europe and North America. Using the islands as a refueling station enabled air transports to reduce the round-trip flying time from the USA to Africa from 70 to 40 hours. During the latter part of the war, airbases were located on Santa Maria (now CU1) and Terceira (CU3). It was the "Grand Central Station" of the Air Force, serving the American-European Theatre with as many as 900 aircraft and 13,000 crew members and passengers passing through the islands in a single month.

When the British left Terceira in 1946, the US moved its military operations from Santa Maria to Lajes Field on Terceira. Since then, the American presence has remained as a result of periodically negotiated agreements between the US and Portugal. Today, Lajes Field is rather unique—the US Army maintains boats, the Navy flies planes, and the US Air Force takes care of the base! Yes, you read it right—more on this interesting bit of "military intelligence" next time.

Hams on Terceira helped local Scout troops participate in the annual Jamboree-on-the-Air (JOTA). JOTA, an annual event since 1958, brings together Scout troops worldwide via amateur radio. The Azores Regional Office of the CTT (the local licensing authority) issued the special call CU31OS for our JOTA station. Sr. Manuel Valadao CU3CS and I provided a station for the Scouts to use and supervised the operation. The CTT temporarily waived the usual third-party restrictions so the Scouts could communicate directly with other Scouts. We made many interesting contacts, including a QSO with OM3SCT, the station located at the headquarters of the Czechoslovakian Scouts. They told us that because of the liberalization of Eastern Europe, they were now allowed to have a station and participate in JOTA—something they couldn't do before. Naturally, they were very excited. All the other stations we contacted displayed the same enthusiasm, friendly spirit, and international goodwill that many of us were afraid had disappeared from the ham bands. Too bad each day couldn't be like that (especially on 20 meters)!

Until next time, 73 de Mike KB3RG/CU3LF.

ISRAEL

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Emergency Autopatching Allowed

For years, the Israel Amateur Radio Club has been lobbying the Ministry of Communications to allow some kind of emergency autopatches on the IARC repeater network. Finally, the efforts have paid off.

In the office of the Minister of Communications himself, Mr. Raphael Pinhasi, a ceremony of granting of authorizations to various parties was held, and those representing the Israel Amateur Radio Club were presented with a document. It permits the use of "an automatic device" on repeaters which can dial only the three-digit numbers for Police, Fire Department, and Red Star of David (the Israeli equivalent of the Red Cross) ambulance and first aid service.

No one will be able to dial home to find out how many liters of milk we were supposed to bring home, and the other three-digit numbers for services such as telephone directory assistance are also out-of-bounds. Another stipulation is that the service may be used only in emergency situations, and the Grade "C" Novice class licensees, who just over a year ago received VHF voice privileges, will not be allowed to use the autopatch.

A little background information: In the past, regular phone patching has been permitted to Grade "A" licensees (Advanced/Extra equivalent in the US) who are the only amateurs allowed to let a third party speak over their stations while the licensed ham remains physically in control of the transmitter. Grade "B" (Generals) could never legally use a phone patch, nor could they let someone else's voice go out on their transmissions. Until a number of years ago, the Grade "A"s had to pay a special license fee for a phone patch, but fortunately there has been some liberalization here. As for regular North American style autopatches, the Ministry of Communications has been adamant in their refusal to consider them.

What all this means is that soon a ham driving down the highway running into an accident will be able to ring up the authorities immediately, and this can mean the saving of lives. I don't understand why the 4Z9s (Novices) have been denied this service, as they have no enjoyment of their hobby added by this privilege, unless the Ministry believes that they can abuse the use of the emergency autopatch.

The IARC executive has already authorized the use of funds for installing the autopatches in the repeaters serving the major population centers, and it is hoped that this service will bear fruit in the further liberalization of third-party traffic in Israel.

NEW ZEALAND

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New Zealand

"Kia Ora" from ZL land again! "Have A Go (Again) 160m Activity" is again on the ZL programme for the 1992 year. Due to multiple requests to "do it again" the Hastings Branch of NZART has set up the following event for your participation and enjoyment.

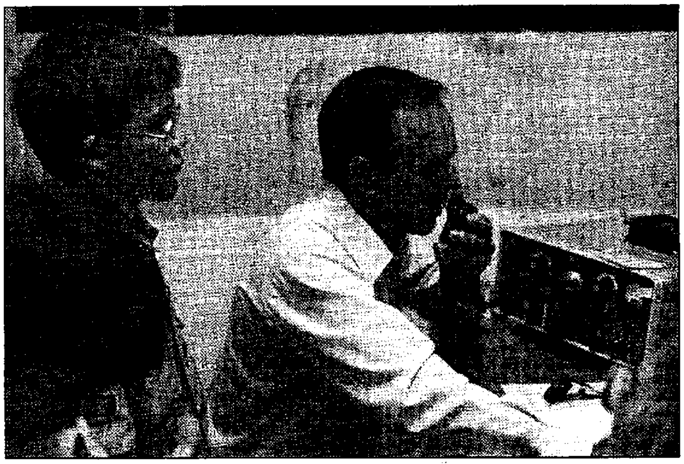

Photo B. Sr. Manuel Valadao with Scouts and equipment CQing on 15 meters during JOTA.

Get a group together and "borrow" a tower or crane or something at home (an 80m dipole works fine) and come up on 160m in March 1992—details follow: 1840 ±10KHz, 0800z–1200z, 20 and 21 March 1992. *[Hopefully some of you readers will get this copy early enough to participate. I sure plan on setting my alarm to "give it a go," even with my minuscule station—Arnie]*

Well, that's got that off. Now for 1991 in summary. We (NZART) got ourselves a new president, Trevor King ZL2AKW, from Wellington. He replaces Terry Carrell ZL3QL, who held the post for the last three years. Trevor is a keen construction man, being the "author" of many kit-set projects set up by the branch he belongs to. He is, of course, also an active ham operator.

Our Frequency Management Group, the NZART group who make recommendations on band plans, uses, etc., is investigating the use of a FAX frequency in the 2m band. There are several ZL amateurs interested in this new mode of communications.

This year saw the passing of Tom Clarkson ZL2AZ, "Mr. Amateur Radio," in ZL. Tom, known internationally through his IARU Region III associations, was one of our earliest licensed hams, and was President of NZART in 1930, very early in the association's existence. Tom was adamant on two things about amateur radio: the voluntary aspects of our hobby, for which the buzz word is currently "recreational," and secondly, the retention of a Morse code requirement to guarantee our international spectrum allocations against inroads from administrations "strapped for cash." We here in ZL respect his wishes as he was a very wise man in the international fields of amateur radio. He will be missed from amongst our ranks.

The NZART Administration Liaison Office has been attending various meetings with the Ministry of Commerce, our regulatory body, leading up to WARC-92 preparations. Fred Johnston ZL2AMJ will be our representative at the February meeting in Spain.

The recent Cyclone "Val," which devastated Western Samoa and American Samoa, again demonstrated the value of amateur radio in a civil emergency—all communications were lost with Western Samoa when the cyclone struck, with the winds up to 240km/h, and this situation continued for three days—but there were some contacts via amateur radio in those days after the cyclone's strength had abated. Even though there was no power, somehow the hams managed to "fire up" their equipment and get those vital words out about the devastation the cyclone had caused.

Television news pictures of the damage show the "flattening" of all buildings and vegetation, and an eyewitness Australian Army helicopter navigator who flew over the cyclone-ravaged islands said parts of the biggest island of Savai'i looked as if they had been hit by a nuclear blast. He said Cyclone Val had flattened houses, ripped off church roofs, snapped trees in half, and peppered the roads with debris. Some areas were still under water.

Another eyewitness said, "It is like the country has been hit by a sandblaster, and finished off by a water cannon—every building and house has been affected in some way." The damage is reported to be well in excess of NZ$300 million.

So much for the "doom and gloom" reporting. On a brighter note, in this year's CQ Worldwide DX SSB Contest there was again a Kiwi Contest Group on the air from a site close to Martinborough, New Zealand. The team consisted of ZLs 2BI, 2IQ, 2IR, 2ASD, 2BKM, 2BPL, 2BSJ, 2UDF, 2ULG, 3IX, and 4OY.

Their antenna farm consisted of two 13m lattice towers topped with a 3-element yagi for 20m and a monster 6-element 15m yagi, as well as the usual 10m beam mounted atop a telegraph pole at 11m. The 40m antenna was a 4-element vertical maypole array which gave a lot of directivity, but, unfortunately, not enough gain. The group worked 6,500 contacts in the 48-hour period.

73 from ZL-land de Des Chapman ZL2VR. 73

Number 29 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Amateur Radio and the First Amendment

Much has been said and written recently about the use of what we could broadly define as "bad language" on the amateur bands. Now, let's not quibble over what exactly is meant by "bad language." We don't need the Supreme Court's definition to tell us when we've heard a dirty word. The vast majority of us have been quite conversant in the art of bad language since about the age of seven. Let's define "bad language" as any words or topics that you wouldn't use or discuss (or let anyone else use or discuss) in front of your mother.

I don't think I'm going out on any limbs by stating that bad language doesn't belong on the ham bands. I'm not talking about the occasional "hell" or "damn." I'm talking about good ol' fashioned gutter talk. I'll admit right here that what comes out of my own mouth on occasion is not fit for tender ears, but there is a time and a place for everything. (Ask me sometime why I don't use VOX when I operate mobile. It has to do with getting cut off in traffic once and letting out a string of obscenities at the offending driver, which was broadcasted via one of the most populated repeaters on the East Coast.) When I'm transmitting on the ham bands—across town or across the world—I am speaking on a public forum and, like the vast majority of you, I know that is not the time or the place for dirty words.

Many people have called for some kind of enforcement action against those who refuse to clean up their language on the ham bands. With those of us who were brought up right, it strikes a basic chord when we hear someone use foul language in such a public place. Often, the first reaction is to call for some kind of punishment.

Amateur radio is not the only place this happens, either. Whether it's books in a school library, magazines at the local 7-11, a gay rights parade or a KKK rally—take your pick—there's always someone who is going to have a problem—real or imagined—with what someone else wants to say or how they choose to say it.

Fortunately, the founders of these United States knew this was a problem. They lived in a time when you could be imprisoned or even put to death for saying the wrong thing, and they were determined to make sure the government of the United States would not have this power. After much debate, they came up with a set of amendments to the constitution they were hammering out. These amendments, known collectively as the Bill of Rights, list precisely (but not exclusively) the fundamental rights of a citizen of the United States of America. The first of these is arguably the very foundation of the liberties that so many American men and women have fought and died for over the past 200 years. This amendment expressly forbids the government from making any law that would take away a person's right to speak freely. Though tested repeatedly over the course of our nation's history, with very few notable and notorious exceptions (speech that directly threatens the life or property of others, slander, and the questionable restrictions placed by essentially every wartime president since Lincoln), it has remained the simple and straightforward declaration the founders intended.

Before we call for the immediate tar and feathering of bucket-mouthed hams, let's take a deep breath and realize exactly what we are asking for. We are saying that we want to limit someone's right to speak because we disagree with what they are saying. It's that simple. The reasons we disagree may be well-founded morally, religiously, philosophically and/or rationally. That doesn't change the fact that by calling for punishment for those whose use of language does not agree with our definition of "proper," we are expressly asking the government to make a law that will take away a person's right to free speech.

The First Amendment was not designed to protect the speech that we agree with. Its precise and direct purpose is to protect the speech that we disagree with, no matter how objectionable or offensive that speech may be. That is the trade-off this country made 200 years ago for the guarantee that no citizen would ever be gagged by a repressive government.

If you don't like the implications of this idea, just think about the alternative. If a government can stifle the speech you disagree with, what's to stop them from restricting the speech you *do* agree with? Once you place *any* restriction on *anyone's* speech, you set a precedent that could eventually shake the very foundation of American liberty. Remember, the laws that these potty-mouthed children are hiding behind to display their mental disfunction are the same laws that allow you to criticize your government, worship the way you choose, and talk about the weather on 2 meters.

By now, many of you are saying, "But what about FCC regulations? Don't they expressly forbid bad language on the amateur bands?" Yes.

Continued on page 101

Number 30 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson AZ 85541

The bands for April ought to be pretty good for some of the month, with fine DX opportunities on the best days, shown as G (Good) on the calendar. For those of you who can only operate on weekends, your chances don't seem to be as good as those who can operate during the week. The *worst* days of the month will center around the 5th, when you might hear and see some celestial fireworks, and again on the 11th through 13th and 17th through 19th. The best days for you to work those rare ones will probably occur around the 1st and 2nd, the 15th, and for the 10 days between the 20th and 30th. The remaining days will be Fair, or trending one way or the other, toward Good or Poor. Use the calendar, along with the band-time-direction chart for your best opportunities, and listen to WWV at 18 minutes after any hour for the latest summary of propagation conditions. You want the A index to be Low (below 15) and the Solar Flux index to be high (above 175).

In April, the DX bands from 20 meters and above will open early and stay open late, with the highest bands closing first. . . well after dark. You can expect weather-related QRN in the Northern Hemisphere this month, hence the bands below 20 meters (30, 40, 75–80 and 160) will suffer from thunderstorm effects, especially surrounding the days marked P (Poor) on the calendar. Effective short skip will gladden your heart as well on those days reading F(Fair) or G (Good). ■

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	[illegible]
ARGENTINA	15	[illegible]	20	40	40	—	—	10	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	20	20	20	20	40	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	15	[illegible]	[illegible]	[illegible]	[illegible]	15	15	10	10	10	20	10
ENGLAND	20	40	[illegible]	[illegible]	40	—	—	15	10	15	15	20
HAWAII	[illegible]	15	20	20	[illegible]	[illegible]	20	20	—	—	—	[illegible]
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20				20	20	—	—	15	[illegible]
MEXICO	15	[illegible]	[illegible]	[illegible]	[illegible]	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	[illegible]	10	—	—	15
PUERTO RICO	15	[illegible]	[illegible]	[illegible]	[illegible]	15	15	10	10	10	20	10
SOUTH AFRICA	[illegible]	40	20	20					10	10	15	15
U.S.S.R.	40	[illegible]	20	20	—	—	—	[illegible]	[illegible]	—	20	20
WEST COAST	[illegible]	[illegible]	[illegible]	40	40	—	—	[illegible]	[illegible]	[illegible]	[illegible]	20

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	15	20	20	20	—	20	20	—	—	—	[illegible]
ARGENTINA	15	15	[illegible]	[illegible]	20	—	—	10	—	—	10	[illegible]
AUSTRALIA	[illegible]	15	15	—	20	[illegible]	40	20	—	—	15	10
CANAL ZONE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]	[illegible]	10	20	10
ENGLAND	20	[illegible]	20				—	—	15	15	20	20
HAWAII	15	15	15	20	20	[illegible]	40	20	—	10	10	10
INDIA	15	[illegible]	—	—	—	—	—	[illegible]	15	—	—	—
JAPAN	[illegible]	15	20	20	20	—	20	20	—	—	—	[illegible]
MEXICO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—		[illegible]	[illegible]	10	10	10
PHILIPPINES	[illegible]	—	20	20	—	—	—	—	[illegible]	[illegible]	—	—
PUERTO RICO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]	[illegible]	10	10	10
SOUTH AFRICA		—	20	20	—	—		—	15	15	[illegible]	20
U.S.S.R.	—	—	—	—	—	—	—	15	15	15	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	[illegible]	15	20	20	20	—	20	20	—	—	15
ARGENTINA	[illegible]	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	[illegible]	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	[illegible]	[illegible]	[illegible]	—	—	—	10	10	10	10
ENGLAND	20	20	—						15	15	[illegible]	20
HAWAII	[illegible]	[illegible]	15	[illegible]	[illegible]	[illegible]	40	—	15	10	—	—
INDIA	—	15	20	—	—	—	—	—	[illegible]	15	—	—
JAPAN	[illegible]	[illegible]	15	20	20	20			20	—	—	15
MEXICO	10	15	[illegible]	[illegible]	[illegible]	[illegible]	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	[illegible]	—	—
PUERTO RICO	10	15	[illegible]	[illegible]	[illegible]	[illegible]	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20	—	—	20	20	20	20	20
EAST COAST	[illegible]	[illegible]	[illegible]	40	40	—	—	[illegible]	[illegible]	[illegible]	[illegible]	20

[illegible]

APRIL 1992

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G–F	3 F–P	4 P
5 P	6 P	7 P–F	8 P–F	9 F	10 F	11 F–P
12 P	13 P–F	14 F–G	15 G	16 G–F	17 F–P	18 P
19 P–F	20 F–G	21 G	22 G	23 G	24 G–F	25 F–G
26 G	27 G	28 G–F	29 F	30 F–G		

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts, then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a new newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 and get set for the phone calls.

Deadline for the May classifieds is March 12, 1992

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ICOM IC3AT WANTED. N8JHJ 2721 Riverview Ave., Huntington WV 25702 NO CALLS PLEASE BNB837

RANDOM OUTPUT

Continued from page 98

they do, and in a perfect world those regulations would be adhered to and enforced. In reality, the FCC is not about to enforce that regulation for two reasons. One . . . the first Amendment. The FCC knows that it is very difficult to get a ruling in their favor when the infraction in question has anything to do with the First Amendment. Two . . . the Amateur Radio Service is at the bottom of the FCC enforcement ladder. They simply do not have the time or the staff to police the amateur bands for us. That's our job. Even if they had a full-time staff of "Amateur Radio Police," they still wouldn't be going after people for bad language. Why? Refer to reason #1.

So, with legal restrictions and reality in mind, what can we do to instill in these trash-mouths the responsibility that goes along with their rights?

First, let's not forget that we are talking about a very small minority. Except for a particular frequency or two, I can count on my hands the times I've heard what most would label as objectionable language on the ham bands. No, we cannot dismiss those who hang around certain frequencies and display their lack of maturity, but let's keep this problem in perspective.

Second, why the hell (pun intended) are you listening to these people? These adolescents are just looking for an audience, and by listening and responding to them we are giving them exactly what their repressed, underdeveloped minds are craving: attention. I don't know about you, but all of my gear came equipped with tuning controls and an on/off switch. If you don't like what you're hearing on a certain frequency, turn the dial or hit the switch. What gives you the right to tell that person how to speak or what to speak about? And don't forget, if the person who is making you so angry is transmitting illegally (no identification, intentional interference, etc.), FCC regulations forbid you from establishing or maintaining transmissions with that station. If you respond to them in any way over the air, YOU are breaking the rules too!

Let's stop calling for a revision to the Bill of Rights and start using a little common sense when it comes to the few geeks and freaks who haven't grown out of the potty stage. They are a minor eyesore in the amateur radio landscape—one that, unfortunately, we have to tolerate. It's not new advice but it's true. If you take away their audience, they will eventually go away and find some other activity to occupy their overabundant free time.

For every foul-mouthed ham I've ever heard, there have been at least three stations trying to shut him up. It seems that the bigger problem is not the few hams who use bad language, but the far greater number of hams who continue to think they can help the situation by providing an audience. ■

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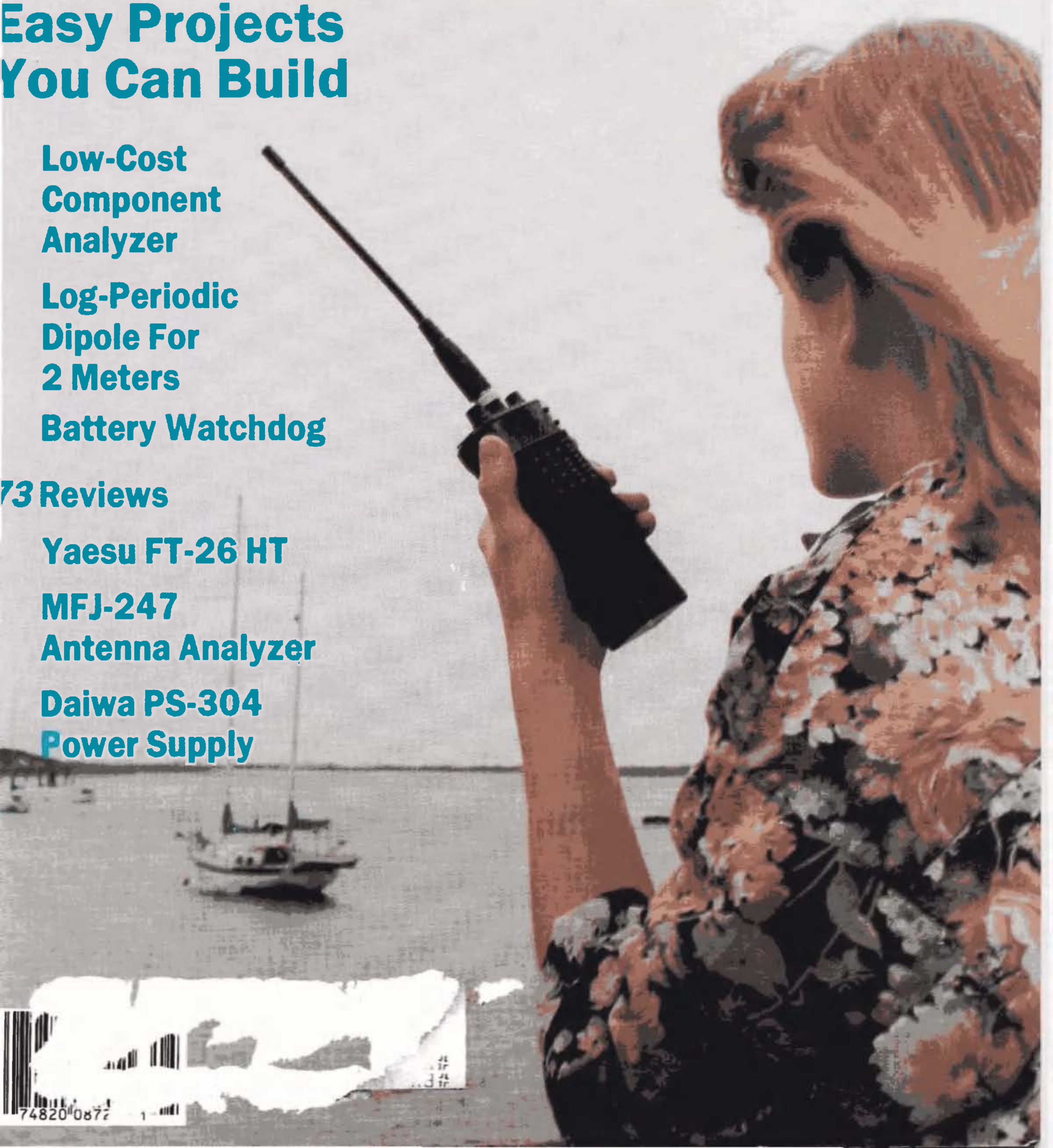

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Paying The Rent

If you've been reading my editorials. . . and if you have anything like the normal 70% retention for written matter. . . you are not unaware that I've been casting about, looking for help in coming up with some sort of plan which would help assure our survival as a hobby.

As I've mentioned, for those of you with incipient Alzheimer's, none of the original reasons for amateur radio's franchise to use our billions of dollars of bands hold much water these days. Knowing that commercial interests are getting more and more frantic for frequencies. . . knowing that several of the more frantic and better-heeled are busy taping the nonsense going on in our bands as a lever to force the FCC to rethink our allocations. . . I've been racking what little is left of my brain for some new rationale for us.

Indeed, I've thrown down the gauntlet on this one (clunk), asking for your ideas as a contribution to my talk at Dayton. Hey, you *are* going to be at Dayton, right? Let's see if we can break 30,000 attendance this year.

Hmmm, that gives me another idea. Let's set up a special room for the 14.313 group to caucus. Once we have 'em in there we can lock the doors and throw in a canister of nerve gas. I'll see if King Hussein, who seems to still be good buddies with Saddam these days, can get some from Saddam for us. Of course if you have a better idea for shutting these A-H's up, please advise. Seems to me that this is a clear case for justifiable euthanasia.

A recent CD release of Gilbert & Sullivan's "The Mikado" reminds me of Koko's song. He's the Lord High Executioner and he lists the people who should be on his list. Well, we hams are building a list too, and it ain't so little. Koko's list is of "society offenders who might well be underground and who never would be missed. . . I've got them on my list, I've got them on my list."

Well, we've got our list of offenders too. The hams who tell dirty jokes and use foul language over the air. The jammers. The pontifical gas bags. The hams who make mean racist remarks. The hams who put down youngster newcomers. And let's not forget any hams who broadcast endless self-promoting blather masquerading as public service.

Darn, I got carried away again. It's just that the vision of scourging the traitors to our hobby was a delicious thought I wanted to share. It's just a tired old man's dream.

Take The Bull

As I often say, it's time to take the bull by the horns and run with it. So here's my plan for building a whole new raison d'etre for our hobby. And here's how you can help.

What I need are testimonials from you telling me how amateur radio has positively affected your life. I need stories of how getting interested in amateur radio as a kid (or later, even) changed your life.

> ***"Hey, you are going to be at Dayton, right? Let's see if we can break 30,000 attendance this year."***

I need success stories from you who've gone on as a result of amateur radio into high-tech careers. Further, if you've done anything outstanding as a result of that, that's even better.

I particularly need success stories from those of you who've started your own high-tech small businesses. . . since small business is the real strength of America. Indeed, 87% of all new jobs have been in small businesses in recent years. We don't need more megacorporations for Wall Street to juggle around. America needs tens of thousands of new small businesses. We need entrepreneurs. And we need 'em most in high-tech industries. . . just what we hams should be able to provide. Just what we have been providing. . . so let's start making this part of the picture visible.

If you'll write testimonials on how amateur radio benefited you careerwise, I'll publish your stories in *Radio Fun* and in the *NIAC Newsletter* (National Industry Advisory Committee). . . which goes to the FCC commissioners and other key FCC decision makers. Let's swamp them with testimonials on how much amateur radio is helping the American economy via high-tech career paths.

If amateur radio has had a positive effect on your life, grab any writing implement you can find. Don't worry about grammar and spelling (we can fix all that), just get your story onto paper. Of course I prefer a disk and printout, but I'll take spiral bound notebook paper with the shreds still on and a stubby pencil. Don't let me down on this one. Please don't make me grovel and have to keep reminding you.

Look, if amateur radio has helped you in life, you owe it something. Well, here's your chance to start paying off that debt. Give me ammunition in the form of testimonials and I'll see that it gets used for the preservation of our hobby.

Please address your stories to Testy Wayne Green, *73 Magazine*, 70 Route 202 North, Peterborough NH 03458.

High-Tech Careers

It's always fun to get letters from readers thanking me for pushing them to start businesses. One recent letter thanked me for suggesting that the home security market was a good fit for hams. He got started in his spare time and gradually built quite a business. It had revenues of $11 million last year.

This is still a rapidly expanding field, with sales overall growing by 10% per year and no end in sight. When you consider that crime costs Americans over $250 per person a year. . . as compared to $12 in Japan. . . and since there's little likelihood of the government making any serious efforts to curb crime, it'll be a growing industry for a long time to come.

Indeed, we have more crime in America than any other developed country in the world, and by a wide margin. We have a greater percentage of our people in prison. . . over 1.5 million. Our main problem is in providing courts and building new prisons fast enough.

The upshot of all this is that the public is more and more responsible for its own protection. Police can't respond to burglar alarms in homes with any speed when 98% of the alarms are false, so the alarms are more harm than help. Handguns kill several times as many kids as burglars. So there's a wonderful growing market for home security.

And security systems do work. They tend to discourage burglars and get them to take their business to less protected homes.

Several readers have written thanking me for suggesting in my editorials about getting into this business.

I've also had several thank-yous from readers who've made careers out of selling computer security systems. Two of them said they followed my sneaky scheme for convincing companies about their computer security problems. They were amazed at how easy it was to listen from hundreds of feet away and get good copy.

Of course if you're happy working for someone else and aren't interested in being your own boss. . . and setting your own salary. . . and don't have to worry about being jettisoned when sales drop. . . or finding yourself a no-longer-needed middle management person. . . well, never mind.

I figure it's a lot easier to start a small business in your spare time before you're out of work and money than to wait until you're desperate. It's the "plan ahead" concept.

Once the business has grown to where it can support you, fine. Then you'll make it grow more and start hiring help. . . which is where you'll find out about the real world. Heh, heh.

The great proportion of small businesses are not aimed at high growth. Most of 'em are started by people preferring to be self-employed. They're not entrepreneurs, just small business people. Yet it's these small businesses which are the real strength of our country and provide 87% of all jobs.

Entrepreneurs are a different lot. They're not interested in making money or in security, they're after growth and have a mission which transcends money. Oh, they know they have to make money, but that's a detail. Hams jealous of what I'm doing sometimes accuse me of being after the buck. That's what psychology calls "projection." That's their problem, not mine. People with psychological problems tend to project them onto everyone else.

That's not a bad concept to keep in mind. When you meet someone who is distrustful, watch out! Projection is very common.

This recession has millions of Americans edgy, worrying about their jobs. Instead, it should be a time of opportunity. It's a time to look for new businesses that are needed.

For instance, a chap consulted with me recently. He'd been laid off from a large photo finishing company's upper management. Okay, here's a business he knows, so why not take advantage of it? I suggested he start putting card-

Continued on page 60

LETTERS

Number 2 on your Feedback card

From the Hamshack

Willard Shears W2IOS, Rockford IL Well, Wayne, you did it. I've been a silent subscriber since 1962. I was W8HYE then, and promised not to live too long in order to get a lifetime subscription. I am a chief engineer at WIFR in Rockford, and am sort of tired of fixing the same stuff. I am a "fixer." I can fix about anything you can plug in. I want to teach this and other skills to the kids who have nowhere to go, and I would like to teach electronics and repair to the underprivileged.

I have had the luxury of being able to take time to have fun. I still enjoy designing things, re-using equipment that was ready for the scrap heap. I would like some ideas on where to go, what to do, to get some of that pork that is floating around to make some headway in getting a new generation of kids able to do something other than swap bad boxes when something breaks. Maybe you have an idea of how hard it is to get good maintenance techs; I know how hard it is. I want to start a tech school for kids, laid-off adults, and even dropouts who wake up. I want to make them even better than DeVry. I have had two DeVry grads, and they are better than a lot, but need a lot of training. If hamming would help, I would use it.

So, keep up the editorials. You finally got me off my duff to write. Let's get it going. I want to live long enough to give my four kids a problem. Meanwhile, I'll continue to OD on editorials. Most fun I've had in years.

Ed Fox, Morgan Hill CA This last summer, while vacationing at my in-laws', I found a notice about a class in the new no-code Tech license. It was taught by a remarkable man, Curtis Nakayama. His knowledge and stories, imparted in that wondrous soothing lilt from the Hawaiian islands was a marked contrast to other experiences I'd had with hams.

Like any other new ham, I went shopping. I stopped at the local store in San Jose. I'd been in there before, but now felt like I belonged. Imagine my surprise when I was ignored just like before. The other surprise was the cost!!

My other surprise was to not be contacted by anyone after receiving the license. I think that any organization or group fighting for its survival would have leaped at any prospective new member. But the ARRL didn't make any effort to involve me, even after I purchased material from them aimed at learning the code and the tricks to getting a new station started.

I read your editorials with each new issue of the magazine. I liked your editorial emphasizing the human communication part of ham radio. I disagree with most of your indictment of education. I agree with your comments about needing to welcome newcomers. And, your recent column about the limited utility of the Amateur Radio Service is precisely accurate.

Given the cost, the way the ham field has changed since I was a kid, and the problems I note in the various ham journals I have read, I fear I am going to be one of those who gets his first license and then quits. For me, the major drawing card was a chance to communicate with kindred spirits around the world, as exemplified by Curtis Nakayama.

As for education, there is a germ of truth in what you write, but your diatribes miss some difficult-to-accept truths about us as a country. Back when you were in school, and even when I was in school, the proportion of the population which was like you, and me, was much greater than today. Proportionally, we funded education at a much higher rate than that now. We systematically excluded difficult-to-educate students, counting on the job market to absorb them.

Today, most of America's students come from urban areas. Yet those urban areas feature schools neglected by the rest of us. We forced public educators to unionize because we constantly devalued and denigrated their efforts. It is a built-in contradiction to insist that educators become highly educated, then insist that their opinions and reasonings are not worthy of consideration. We give our kids to these professionals and then expect the professionals to do the work of the family and the society.

Make no mistake—there are some teachers who, as an administrator, I would love to remove from education. But, for every one of them, there are five to 10 teachers I would love to reward by doubling or tripling their salary. Would you tolerate a teacher making $100,000? I doubt it, but we have no trouble with salespeople, lawyers, accountants, and stockbrokers making that amount. None of these occupations produce wealth, or the means to increase knowledge. But, to entice our best into education with salaries like that is anathema. Then we rant and rave about our educational system failing us. Go figure it out, I can't.

Let me personalize the situation. A typical shack, as best I can figure from advertisements, must cost $3,000 to $5,000. How many hams would be willing to donate that amount to a school? Teachers and useless administrators are over-paid? Public schools are no longer seen as a part of us as a society. As your world of ham radio has changed, so has the make-up and demands of public schools. That $3,000 to $5,000 we would not think of parting with reflects the cost of educating a student today.

I encourage parents and communities to take back their schools if they feel left out. But, take them back by re-owning them. Put in your time there, even if your kids are long gone and even if the kids don't look like your kids did. Insist that buildings and facilities are ones you would like to work in, or that you would want your kids to work in. Insist that schools excel, but be there to acknowledge all the steps along the way to that excellence.

If we want the achievement of Japanese and Korean schools, we must change our attitude toward schools. We must prize them. We must believe that schools and school people are just like we are and respond to approval.

Yes, schools need to change. We cannot continue doing business as usual in many instances. Few among us eagerly seeks change. Even hams are known to cling to familiar ways which are no longer appropriate. Ham radio is a hobby, whereas education is a necessity. We cannot let public education die or disintegrate.

You seek ideas for the perpetuation of the Amateur Radio Service. Why not link hams with schools? Grant school-based shacks unique frequencies and priviliges to encourage hams to enter schools. Encourage the ARRL to reach out to schools. For example, here in California, funds are available for restructuring schools. Why can't hams be a part of a changed delivery system for students?

Most likely we will hear a response like, "That's the school's job. I did my time with my kids." At that point, Mr. Green, I rest my case about the demise of the Amateur Radio Service and the continued deprivation of critical resources to our kids.

As for my ham career, it's too soon to tell. Maybe my path will cross another Curtis Nakayama. Maybe a rig will fall off a passing truck. My interest is certainly waning. From a different perspective than yours, I ask, "What's in ham radio for me?"

I hope our interests converage enough to save both our interests, education for me and ham radio for you.

R.L. Stevenson VY2RLS, P.E.I. Canada Regarding your "Never Say Die" column about old-timers in the September 1991 issue: It was for this particular reason that we founded a new club. We amateurs, new to the fraternity, who have the basic qualifications, had been stifled by the old fogies who wanted nothing more than to have control of the club and all (if any) resources. In fact, the members of the local "seniors" amateur club are now the executives of the local open club. The former club was initiated to "further amateurism among seniors," or in my opinion, to get as much money as possible from the government for a seniors' project grant. They got ($20,000) to buy equipment. This sum was larger than anything any of the old farts had ever seen in their lives and they couldn't figure out how to spend it wisely. They went out and bought two (yes, two!) of just about everything (in case one breaks down).

Now the Seniors' Club has two TS440s, two handhelds, two power supplies, and an autopatch (that, incidentlly, seldom works, but they only got one of them). Anyway, my point is this: The seniors wanted to rest in the secure knowledge that the new upstarts would be subservient to them because, after all, who knows more about radios and equipment than a "senior"? Albeit to their dismay, a number of us wanted to go a little further and get our Advanced license but we couldn't because of the stifling atmosphere. Now, a number of us are striving for that goal and anticipate a very near completion date. So, in response to your column, you hit it right on target!

I find *73* to be a very informative and enlightening magazine. In fact, a buddy of mine and I buy alternating months and when we're finished reading we leave it in our clubroom for the rest of the members to peruse.

Greg Smith N8PPZ, W. Carrollton OH I really love your editorials. It is nice to finally find someone who thinks like I do. I have been a no-code tech since August, and I am proud of my call. I enjoy ham radio so much that I keep trying to make it better, but I don't think anyone is willing to help my crusade.

I am 21 years old and I go to Sinclair Community College full time, majoring in mass communications. I work part-time for WDTN TV-2 here in town as a robotic camera systems operator/programmer/crew trainer. I also produce my own television shows at the local public access cable station. I am very busy, but yet I manage to have time to participate in the number one hobby in the world.

When I got some spare time I decided to spearhead an effort to start an amateur radio club at the college. I never imagined I would get so much negative reaction from the Student Government Association. They must approve all clubs. I had done some research and found out that at one time there had been a ham club there, but it died over five years ago. There is still station equipment being stored on campus, and the triband beam is still up on top of one of the buildings, in decent shape. So when I approached the SGA with my idea, they said, "It wouldn't appeal to enough students." That's a bunch of crap. I personally know seven hams on campus, two of whom teach classes at the school and would be willing to sponsor the club. In a school that has over 20,000 students enrolled, I calculate between 15% and 20% are hams, scanner buffs, SWLs, or are interested in learning about ham radio. That is more than the basketball team, the chess club, or any other organization on campus. I believe the key to making such a club successful is in the way it is marketed and how visible it is. What could be a better teaching aid for a student in social studies who wants to learn about foreign countries? Or a communications major who wants to develop skills? Or an electronics student who needs hands-on training? All of these areas have potential. The SGA is too narrow-minded to see this.

Another area I think needs to be improved in ham radio is the upgrading of no-coders. I have found that the local ham club doesn't seem receptive when asked if they would provide a code-only course for us to upgrade to Technician-plus status. They say they already offer Novice and General classes. Well, I don't need the Novice theory, and I don't know the code well enough to take the General class. I am struggling through with the tapes and computer programs, so one way or another I WILL pass the five-word code test before I attempt to take the General class.

Once I do manage to upgrade I will be in a unique position to teach ham radio: Public Access Television. I can produce a training show for those still interested in the Novice ticket, the no-coders wishing to get code, and the people who want to get a no-code license. I guarantee it will be a lot more convenient than the occasional classes the local club offers. It might just make our stalwart leaders get off their duffs and do something constructive for the hobby, once they see an increase of people testing, and a decrease in attendance in their classes.

As you can see, Wayne, I am doing something. I am trying to promote our hobby, and I am trying to infuse fresh blood into it. I and others like me are the future of not only ham radio, but America in general. Are we going to sit back and accept tired old practices, just because that was the way things were done in the past, or are we going to change things and move into the '90s? After what I have gone through, and continue to struggle against, I can see why, after all the years, you have been doing what you do, and why you continue to do it. 73

QRX . . .

73 Has Moved

73 Amateur Radio Today has a new headquarters. As of March 31, 1992, our address will be: *73 Amateur Radio Today*, 70 Route 202 North, Peterborough NH 03458; telephone: (603) 924–0058.

Bringing the Novice Class Under the VEC System

Attorneys for the American Radio Relay League and the W5YI-VEC have filed separate petitions for rulemaking with the Federal Communications Commission requesting that future Novice class amateur radio license examinations be administered under the current VEC System.

The W5YI-VEC and the American Radio Relay League VEC together account for approximately 80% of all operator license examinations administered in the VEC System. The W5YI-VEC petition was filed on February 26 and coordinated with the ARRL request filed the following day.

The privatization of the amateur operator license examination function from the government to the VEC System has turned out to be a success story, of which the FCC and the amateur community can rightfully be proud. According to FCC statistics, last year 103,251 applicants were served at 8,118 test sessions, an increase of 62% over the previous year.

W5YI-VEC pointed out that "Newcomers have flocked to the service via the Technician class license, despite the fact that the examination setting is less formal than the Novice class setting, and despite the fact that they may be charged a modest fee to defray the cost of the examination." *TNX W5YI Report, March 15, 1992.*

Armed Forces Day Communication Celebration

On Saturday, May 16, 1992, the Army, Navy, Marine Corps and Air Force will cosponsor the 43rd Annual Armed Forces Day Communication Celebration. The Amateur Radio Program, presented in celebration of Armed Forces Day per Department of Defense directives, will feature the traditional military-to-amateur crossband communication test and message receiving test. The tests give amateur radio operators and shortwave listeners an opportunity to demonstrate their individual technical skill and to receive recognition from the Secretary of Defense or the appropriate military radio station for their proven expertise.

The proceeding will include operations in continuous wave (CW), single sideband voice (SSB) and radioteletype (RTTY). Participating military radio stations will award commemorative acknowledgement (QSL) cards to amateur radio operators achieving a verified two-way radio contact. Special commemorative certificates will be awarded to anyone who receives and accurately copies the Armed Forces Day CW and/or RTTY message from the Secretary of Defense. All contacts must be acknowledged by QSL card or certificate to validate military interest in these operators.

Military-to-amateur crossband operations will take place from 16/1300Z (UTC) to 17/0200Z (UTC) May 1992. Military stations will transmit on selected military frequencies and listen for amateur radio stations in the amateur bands indicated below. Frequencies assigned below are the "Assigned Frequency." To derive the "Window Frequency," drop 1.5 kHz from the "Assigned Frequency" for USB. For example: 4005.0 kHz (Assigned Frequency) – 1.5 kHz = 4003.5 kHz (Window/Dial Frequency). The military operator will announce the specific amateur band frequency being monitored. Duration of each contact should be limited to three minutes.

Ham Testing Fraud

The FCC has used amateurs working in an undercover sting operation to investigate alleged VE testing fraud at ham radio schools in California. The FCC acted on complaints that applicants were able to buy Extra class licenses at some VE test sessions and in some amateur radio schools.

The undercover hams, posing as applicants, used concealed tape recorders. Evidence of wrongdoing was found, according to the FCC, but no names have been released, pending completion of the investigation. *TNX "The Birmingham," newsletter of the Birmingham (Alabama) Amateur Radio Club, February 1992, and the ARNS Bulletin, March 1992.*

Station	Military Frequency	Emission	Amateur Bands
AAE	4030.5 kHz	LSB	80 Meters
Army HF/MARS Radio	7358.5 kHz	RTTY/CW	40 Meters
Facility	13994.5 kHz	USB	20 Meters
Fort Sam, Houston TX	20941.5 kHz	CW	15 Meters
	27992.5 kHz	USB	10 Meters
AAH	4021.5 kHz	LSB	80 Meters
ARMY HF/MARS Radio Facility	6988.0 kHz	RTTY/CW	40 Meters
Fort Lewis, WA	10151.5 kHz	USB/CW	30 Meters
	14488.5 kHz	USB	20 Meters
	20975.0 kHz	USB	15 Meters
	20995.5 kHz	RTTY/CW	15 Meters
	27820.0 kHz	USB	10 Meters
AAR	4033.5 kHz	LSB	80 Meters
ARMY HF MARS Radio Facility	7309.5 kHz	RTTY/CW	40 Meters
Fort Bragg, NC	14440.0 kHz	USB	20 Meters
	20105.5 kHz	USB	15 Meters
	27810.0 kHz	USB	10 Meters
AIR	4025.0 kHz	LSB	80 Meters
89th Communications Group	6995.5 kHz	CW	40 Meters
	7315.0 kHz	LSB	40 Meters
Andrews AFB	13986.5 kHz	RTTY	20 Meters
Washington, D.C.	13997.5 kHz	CW	20 Meters
	14408.0 kHz	USB	20 Meters
NAM	4005.0 kHz	USB	80 Meters
Naval Computer Telecommunication Area	14400.0 kHz	USB/RTTY/CW	20 Meters
Master Station LANT			
Norfolk, VA			
NAV HQ	7372.5 kHz	RTTY/CW	40 Meters
Navy-Marine Corps MARS Radio Station	14389.5 kHz	USB	20 Meters
Cheltenham, MD			
NAV-84006.5 kHz	Various	80 Meters	
DIRNAVMARCORMARS REG EIGHT	14820.0 kHz	Various	20 Meters
530 Peltier Ave.			
Honolulu, HI	18900.0 kHz	Vanous	20 Meters
NMH	4015.0 kHz	CW	80 Meters
Coast Guard Radio Station	7346.5 kHz	LSB	40 Meters
Alexandria, VA	14440.0 kHz	RTTY/CW	20 Meters
	20937.5 kHz	USB	15 Meters
NMN	7393.0 kHz	RTTY/CW	40 Meters
Coast Guard Comm. Area Master Station			
Cheasapeake, VA			
NPG Naval Comm. Station	8970.0 kHz	CW	40 Meters
Stockton, CA	7301.5 kHz	LSB	40 Meters
	7365.0 kHz	CW	40 Meters
	10259.5 kHz	CW	30 Meters
	13927.5 kHz	RTTY	20 Meters
	13975.5 kHz	CW	20 Meters
	14375.5 kHz	USB	20 Meters
	20625.0 kHz	USB	15 Meters
	24805.0 kHz	CW	12 Meters
	27950.0 kHz	USB	10 Meters
NPL Naval Comm. Station	7382.5 kHz	RTTY	40 Meters
San Diego, CA	14385.0 kHz	USB	20 Meters
NZJ Marine Corps Air Sta.	7375.0 kHz	RTTY	40 Meters
El Toro, CA	14480.0 kHz	USB	20 Meters
WAR HQ Army MARS Radio Station	4018.5 kHz	LSB	80 Meters
Fort Detrick, MD	6998.5 kHz	CW	40 Meters
	13992.5 kHz	RTTY/CW	20 Meters
	14403.5 kHz	USB	20 Meters
	20995.5 kHz	USB	15 Meters

a. Stations copying AIR send entries to:
Armed Forces Day Celebration
89CG/DØJM
Andrews AFB, D.C. 20331-6345

b Stations copying NAM, NAV, NMH, NMN, NPG, NPL, NZJ and NAV-8 send entries to:
Armed Forces Day Celebraton
HO Navy-Marine Corps MARS
BLDG-13 NAVCOMM DET Cheltenham
Washington, D.C. 20397-5161

c. Stations copying AAE, AAH, AAR, or WAR send entries to:
Armed Forces Day Celebration
Department of the Army
U.S. Army Information Systems Command
ATTN: ASOP-HF
Fort Huachuca, AZ 85613-5000

(This is a partial listing. For a complete list of frequencies and modes, contact one of the stations listed above.)

Table 1.

Poor Ham's Dynamic Component Analyzer

Build your own circuit detective.

by T. S. Rowinski KA1MDA

As technology becomes more complex, the test equipment needed to troubleshoot problems becomes more complicated as well. Twenty years ago, the only test gear required to repair virtually any consumer electronics product was a VOM, and an oscilloscope was a luxury many had to do without. Today, an oscilloscope is a must!

One of the newer diagnostic trends involves the use of active component analyzers. Part oscilloscope, part curve tracer, and part signal injector, these units typically fall into two categories: self-contained portables with built-in CRT, and accessory units (usually part of a test jig) designed to be used with an outboard oscilloscope. Both types are priced beyond the reach of the average ham or electronics hobbyist, with prices ranging from $400 to $1,000!

After a bit of research, it became apparent that all these units functioned on the same principle. The analyzer supplies a current-limited AC sine wave to the device being tested, and displays the resulting current and voltage relationships on an X-Y display CRT. This creates a "signature," a unique pattern which identifies the characteristics of the device being tested. The commercially available units also feature a myriad of bells and whistles, such as automatic signature comparison, various test frequencies, waveform storage, etc.

Since I already owned an oscilloscope, all I needed was an accessory-type analyzer. I sat down at the drawing board and came up with the Poor Ham's Component Analyzer. Although this unit lacks the bells and whistles of the big bucks analyzers, its basic effectiveness and operation are identical. The project itself is very easy to assemble, and requires only a handful of common junk box or hamfest parts. All components also have a high "fudge factor" and can be substituted for almost anything the builder has on hand. For those without a junk box, a parts list of Radio Shack equivalent part numbers is included. The best news, though, is that total cost of construction, if all parts are purchased new, is less than $25!

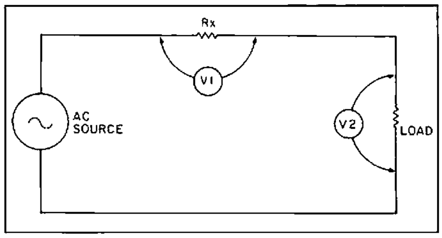


Figure 1. Theoretical circuit diagram.

How it Works

The basic circuit theory is quite simple (see Figure 1). A load is fed by an AC source through a current-limiting resistor. A voltage reading at point V2 indicates voltage across the load. According to Ohm's law (E = I/R), resistor Rx will develop a voltage drop proportional to the current passing through it. The higher the current drawn by the load, the higher the voltage drop across Rx. A voltage reading taken at point V1 is directly proportional to the current drawn by the load. If the load is purely resistive, both V1 and V2 would rise and fall together as the source voltage increased and decreased through each cycle. If we replace the load with a non-linear device such as a diode, VI and V2 would no longer read in unison. During the first half-cycle the diode might be reverse biased, giving a high voltage and low current reading. During some point of the next half cycle, the diode would become forward biased and conduct, producing a high current and low voltage reading. If an X-Y oscilloscope were connected across points V1 and V2, the scope would display the diode's switching signature and become a dynamic component analyzer!

The actual circuit is not much more complicated than that! (Refer to the schematic in Figure 2.) Transformer T1 converts the 120 volt AC current to 12 volts across the full secondary winding, or 6 volts across the center tap to either end. Resistors R1 (50 ohm, 1 watt) and R2 (10k ohm, 1/4 watt) limit the maximum current which can be obtained from T1 on the low and high range respectively, and create the voltage drop which is fed to the scope vertical amplifier via J1 to display current. Note that the parts list shows two 100 ohm resistors for R1—this is because Radio Shack doesn't stock a 50 ohm, 1 watt resistor, so we make our own by connecting two 100 ohm resistors in parallel. If a 1 watt resistor between 47 and 56 ohms is available, it can be substituted for the resistors shown for R1 in the parts list. Switch S2 is a DPDT type and acts as a range selector. Section S2B switches between the 6.3 and 12.6 volt windings of T1, while section S2A connects the scope vertical input via J1 to the appropriate current-limiting resistor. The test leads are connected to J3, and the oscilloscope horizontal amplifier measures voltage at J2. I1 is a neon lamp assembly with built-in dropping resistor and acts as a power-on indicator. Switch S1 serves as the main power switch, and fuse F1 provides over-current protection in the event of shorted wiring or transformer windings.

Construction

Before beginning construction of this project, please remember that this circuit is powered by 120 volt AC current. The voltages present on the primary side of T1 can be LETHAL! ALWAYS UNPLUG THE UNIT FROM THE ELECTRICAL OUTLET BEFORE OPENING THE CASE! Likewise, never attempt to troubleshoot or modify the dynamic component analyzer while the circuit is live. When working on the unit, do not rely on the front panel power switch to remove power—always unplug the power cord! For additional safety, I recommend that the unit be assembled in a plastic case—do not use a metal chassis! If using a polarized power cord, connect the wider blade to one end of T1's primary and the narrower blade to fuse F1.

Component location and layout is non-critical, and virtually any form of construc-

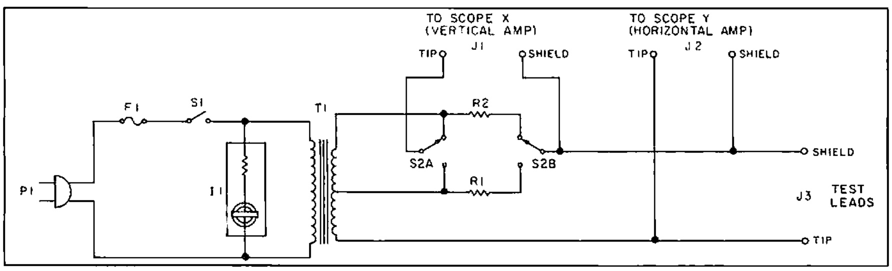


Figure 2. Schematic diagram for dynamic component tester.

tion can be employed, such as perf board, printed circuit board, or point-to point wiring. The prototype incorporated point-to-point wiring across a single, insulated solder-lug terminal strip. The unit can be housed in nearly any type of enclosure, as long as the material is non-conductive. The original unit was built into a 5-1/4″ wide, 2-1/2″ high, 5″ deep plastic project case, which allowed for an open, uncluttered parts layout. If the selected enclosure has no provisions for air circulation, drill five or six 1/4″ holes in an inconspicuous area to allow for the escape of heat generated by transformer T1. Although T1 operates at a relatively cool temperature, heat build-up could become a problem if the analyzer were housed in a small, non-vented enclosure and operated for extended periods of time. Although Radio Shack appears to have discontinued the enclosure used in this article, they offer a number of other suitable enclosures. Figure 3 shows the front panel layout used for the original. I used BNC jacks for J1/J2/J3, although banana jacks or five-way binding posts could have been used just as easily. When wiring the jacks, pay close attention to the polarity—all three jacks should have their negative (shielded) lead hooked to the same point. Reversing the connections on one jack will cause the analyzer to display erroneous patterns or not work at all!

For those who prefer to roll their own with whatever parts are on hand, only a few simple calculations are needed to design a functional unit. Transformer T1 is the heart of the project, and must have a center tap secondary with a terminal voltage between 9 and 20 volts AC. Let's assume the builder has an 18 volt transformer on hand. We need to calculate the ohmic value for R1 to limit current in the low range (R1) to no more than 125 mA. Our hypothetical transformer develops 9 volts across half the secondary, so we use Ohm's law (R = E/I) which gives us R = 9/.125 (remember to convert milliamps to amps), or 72 ohms. The next highest value commercially available resistor is 100 ohms. Using I = E/R, we can calculate the actual current as I = 9/100, which produces 0.09 amp, or 90 mA. To calculate power rating, we use the formula P = IE. Plugging in the numbers, P = 0.09 x 9, or 0.81 watts. Thus a 100 ohm, 1 watt resistor is required for R1. To calculate the value of R2, we use 18 volts, since the entire transformer winding is used in HIGH range, and we want to limit current to a maximum of 1 mA. Using R = E/I, we get R = 18/0.001, or 18,000 ohms. The next highest commercially available value is 22k ohms. Calculating for actual current using I = E/R produces I = 18/22,000, or 0.00081 amps (0.81 milliamps). Power rating (P = IE) calculates to P = 0.00081 x 18, or 0.0145 watts. So, for R2 we need a 22k ohm, 1/4 watt resistor. Using this example, it is possible to quickly calculate the proper component values and for virtually any transformer!

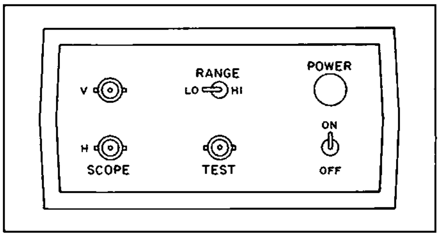


Figure 3. Front panel component layout.

Initial Check Out

Before plugging in the analyzer, a few safety checks must be made to insure proper wiring and operator safety. The values listed below are for units built with the parts specified in the parts list. Set a VOM or DMM to the OHMS x1 range, and connect it across the analyzer's power cord. The meter should measure infinite resistance with SI set to OFF, and about 160 ohms with SI in the ON position. Next, connect one lead of the meter to the negative (or shield) terminal of J3, and touch the other lead to the shield connection of J1 and J2. The meter should read 0 ohms (dead short). Connect the meter across J1 and read the resistance—it should be about 50 ohms with S2 in the LOW position and 10k ohms with S2 in the HIGH setting. Switch the meter to the highest resistance range available (Rx1M on a VOM, or Rx20M on a DMM). Connect one meter lead to a blade on the power cord, switch S1 to the ON position, and touch J1, J2, and J3 with the other lead (be sure to check both the shield and the center contact). If a metal case was used, touch the case as well. The meter should read infinite resistance. Move the meter lead on the power cord to the other lug and repeat the above tests. Again, the meter should read infinite resistance. If the meter reads any resistance at all, stop and check the wiring. Do not proceed to the next step unless all the above tests check out correctly!

Plug the analyzer into a 120 volt outlet, and turn switch SI on. Indicator lamp II should glow. Switch the VOM or DMM to read AC volts, and hook the leads across J3. About 6.5 volts should be present with S2 in the LOW position. Switching S2 to HIGH should cause the voltage to increase to approximately 13 volts. Connect the meter across J2—the same readings should be observed. Connect the meter across J1—it should read 0 volts. Now short the terminals at J3. The meter should indicate around 6.5 volts with S2 in LOW and around 13 volts with S2 set to HIGH range. If all readings were correct, the analyzer is working properly.

Analyze Any Situation

Now we're ready to put the component analyzer to work. Set up the oscilloscope for X-Y operation, and connect J1 to the scope's vertical input and J2 to the horizontal input, making sure the scope inputs are set to DC coupling. Do not use AC coupling, as the low frequency reactance of the scope's internal DC blocking capacitors may distort the wave form. Turn the analyzer on, set range switch

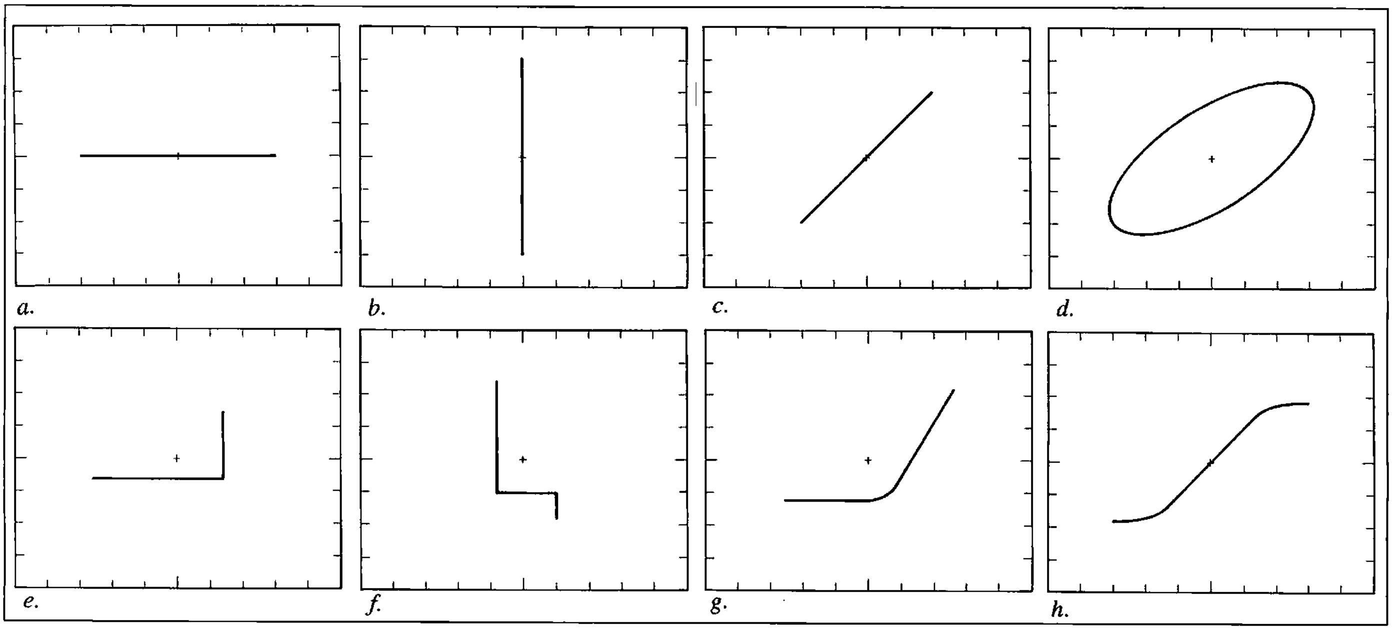


Figure 4. Typical component signatures: a. Open circuit; b. Short circuit; c. Resistor; d. Capacitor/inductor; e. Good P-N semiconductor junction; f. Zener diode; g. Leaky semiconductor junction; h. Non-linear resistance.

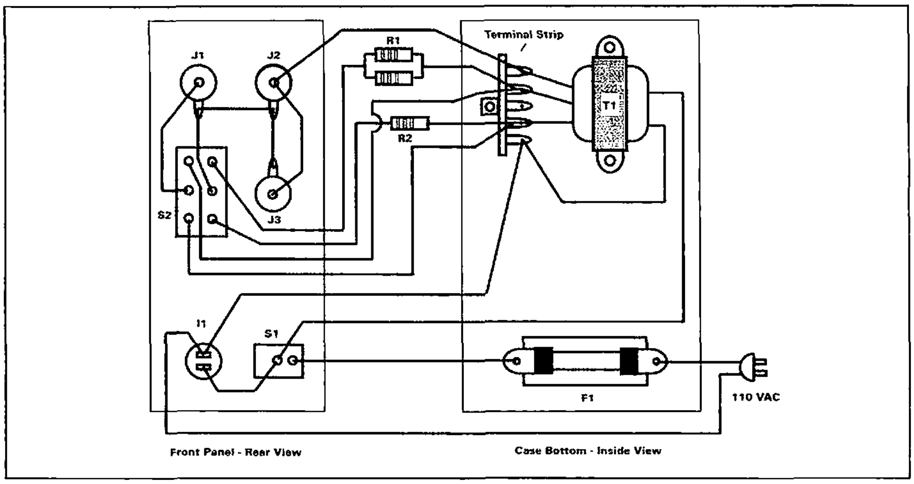


Figure 5. Wiring diagram.

S2 to HIGH, and then switch the scope on. A horizontal line should appear on the CRT. Now short the test leads at J3, and the trace should become a vertical line (if these displays are reversed, swap the connection to the scope). Never turn the analyzer off with the scope on, as this will stop all trace sweep on the oscilloscope, and the resulting stationary spot could burn the CRT if left in place too long! Adjust the scope's input attenuators to obtain a nearly full-scale deflection on the CRT in both axes (about 5 volts per division). The actual attenuator setting or scope calibration is unimportant, since we are not interested in measuring absolute voltage or current values. The trace shape is the important thing.

The dynamic component analyzer can be used to test discrete components in or out of circuit, and can also be used to isolate defective stages in complicated circuits. To test components out of circuit, clip the component across the test leads at J3, and observe the waveform displayed on the oscilloscope. Small signal diodes, transistors, and IC chips are tested in LOW range, while power transistors and rectifiers should be tested using the HIGH range. Resistors, capacitors, and inductors can be tested on either range—simply select the range which gives the most detailed display. When testing capacitors, pay attention to the voltage rating, especially on electrolytics!

Testing components in circuit, or attempting to isolate a defective stage, requires a slightly different procedure. First and most important, do not attempt to use the analyzer on powered circuits! Always make sure the device under test is disconnected from its power source, or severe damage could occur to the analyzer, scope, or unit under test. This warning holds true for the commercial units as well. Dynamic component analyzers are not meant to be used on live circuits!

Dynamic Component Analyzer Specifications

Maximum open-circuit test voltage:
- Low Range : 9.3 VAC peak (6.5 V RMS)
- High Range: 18.8 VAC peak (13 V RMS)

Maximum short-circuit current:
- Low Range : 123 mA rms
- High Range: 1.2 mA rms

Test Frequency: 60 Hz

Input voltage: 120 volts AC

Maximum input power consumption:
- Low Range : 1.8 watts
- High Range: 1 watt

Parts List for Active Component Tester

Qty.	Description	Symbol|RS#Price
1	12.6V CT transformer	T1273-1365$4.29
1	6-foot AC power cord	P1278-1255$1.19
1	5-point lug strip	274-6884/$1.29
1	SPST toggle switch	S1275-624$2.29
1	DPDT toggle switch	S2275-626$2.59
1	neon lamp assembly	I1272-7052/$1.79
1	fuse holder	270-7392/$.99
1	120V, 1/4A fuse	F1270-12713/$.79
2	100 ohm, 1W resistor	R1*271-1522/$.29
1	10 k ohm, 1/2W resistor	R2271-0312/$.25
3	BNC chassis mount jack	J1-3278-105$1.39/ea.
1	plastic case	270-250$3.99

Total cost of project: $23.92

*Connect the two 100 ohm, 1 watt resistors in parallel to create the 50 ohm resistor needed for R1.

To properly test a component in circuit, a known-good "reference" circuit is required, since multiple current paths will tend to distort the analyzer signature. The test leads are alternately placed across identical points on the good and bad boards. Although the resulting pattern may not look anything like it should, the scope traces should be identical between the two boards. When identical test points produce different signatures, the technician has found the defective stage, and further comparison on a part-by-part basis should quickly weed out the defect. Although most readers don't have a spare TS-440S or IC-735 lying around, this is still a viable troubleshooting technique for audio equipment. Most faults with stereo components typically involve only one channel. Thus, the functional channel can be used as the reference for the bad channel!

Component Signatures

Most components under test will produce one of eight main types of traces, or signatures. An open circuit (Figure 4a) produces a horizontal line, while a dead short will produce a vertical trace (Figure 4b). A resistor will produce a diagonal line (Figure 4c), the angle of which will depend on the value of the resistor. Very low resistances will produce an almost vertical trace, while very high resistances will tilt the trace just slightly off the horizontal baseline. Capacitors and inductors cause the trace to appear as an oval (Figure 4d). The shape and angle will vary from a very narrow ellipse to a large, broad circle, depending on the actual value of the component under test. A good P-N semiconductor junction should appear as a right angle (Figure 4e)—a vertical line meeting a horizontal line at a very sharp, well defined 90 degree angle. A skewed vertical line, or a rounded, poorly defined intersection between the two lines (Figure 4g) indicates a leaky semiconductor junction. If the pattern appears reversed, or upside-down, don't worry, as it is a function of test lead polarity. A zener diode should produce a stair-step type pattern (Figure 4f). Again, it doesn't matter if the pattern appears upside-down from the example—the overall shape and definition of the right angles are the important things. Finally, a non-linear resistance will produce the trace shown in Figure 4h. Non-linear inductance and capacitance will produce a similar trace, except that it will appear as an ellipse instead of a line. Three terminal devices such as transistors are tested as three discreet P-N junctions. Hooking the test leads across the emitter and base, the base and collector, and finally the emitter and collector, should produce traces for a good P-N junction, a good P-N junction, and an open circuit, respectively. Although it may seem a bit complicated, the basic patterns are easily learned within a few hours. The quickest way to learn is to grab a handful of junk-box parts and observe the signatures each produces!

The prototype unit described in this article has been in use for a little over six months now, and has proven itself extremely useful, especially in testing semiconductors. I previously tested transistors with an industrial digital multimeter with a built-in diode test function. I was literally shocked to discover how many of my surplus junk box power transistors were actually bad! Although the DMM indicated all the devices were good, the component analyzer showed over 40% of the devices suffered from excessive emitter-collector leakage, poor junction performance, and gross non-linearities! And checking junctions with the analyzer is twice as fast as using the DMM, since there is no need to reverse the test leads for front-to-back comparisons! The tester has also weeded out a number of capacitors which were either leaky or exhibited excessive amounts of series resistance. All in all, the unit has easily paid for itself many times over. The prototype was so successful in the shack that I'm building a second unit for the work QTH!

Log Periodic Dipole Array for 2 Meters

Wideband performance in a small package.

by Dave Koslow N2KLK

I wanted an antenna for backpacking that would be very portable, very small, have high gain, a good f/b ratio, and cover the whole 2m band. Not a small wish list!

Consulting my trusty *ARRL Antenna Book*, I experimented with quads (too bulky and fragile), verticals/ground planes (low gain and not directional), and yagis (too big physically, and small bandwidth). Then I found what seemed to be my dream antenna—the Log Periodic Dipole Array. Never seen one? Just look at the roofs in your neighborhood—many TV antennas are LPDAs!

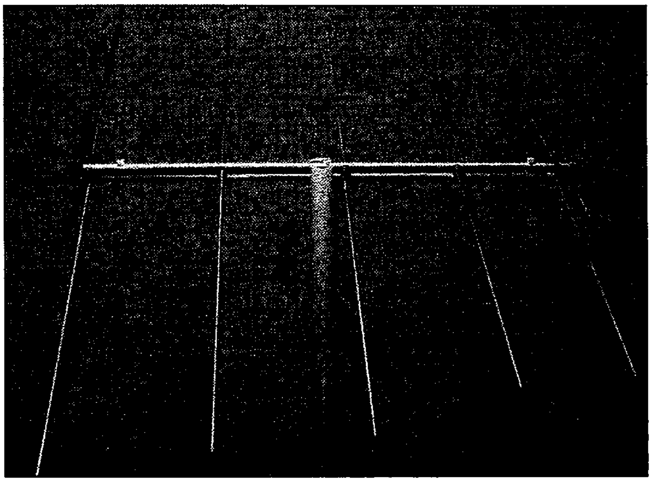


Photo A. Inside full view, horizontal polarization.

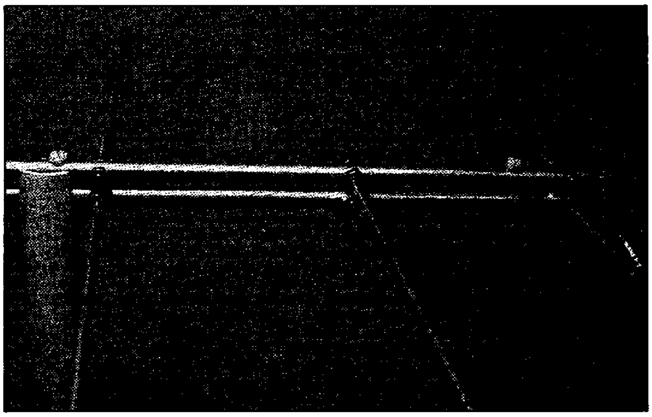


Photo B. Detail of the boom and element, horizontal polarization.

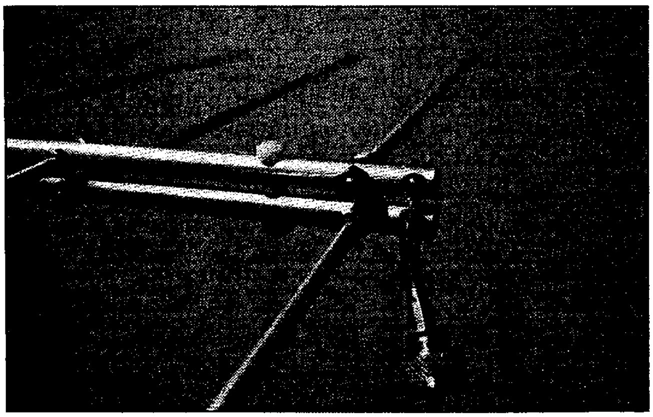


Photo C. Detail of the boom, element assembly and feedpoint attachment.

The LPDA

In these antennas the elements are all driven, and each half is fed 180 degrees out of phase with the other. The feedpoint is at the front of the antenna. All the characteristics, such as SWR, gain, f/b ratio, and pattern, are fairly constant over the entire operating bandwidth. This means you don't have to optimize the antenna for a small segment of the 2 meter band. You can work any mode anywhere in the 4 MHz range and expect consistent performance. At VHF and above, the feeders can double as the boom. This allows for simple, solid construction. While all elements are driven in this system, not all are active at any particular frequency. As the operating frequency changes, so does the area of the antenna that is resonant. The remaining elements act like reflectors and directors. (*The ARRL Antenna Book*, 15th Edition, pp. 10-1 to 10-7.)

With the help of a spreadsheet, scientific calculator, and lots of tea, I worked through the equations to optimize a design. Believe me, this is one antenna project where math had better be your friend!

I arrived at a 5-element design that gave 9 dB gain, about 15 dB f/b ratio, and all on a 2-foot boom! My finished antenna collapses to a bundle about 25″ x 1.5″ and weighs a little over a pound. Not too shabby, huh? Because of its small size, this is also an excellent "stealth" antenna for condos that don't like hams. It looks just like a tiny TV antenna. Its portability and high gain also make it perfect for emergency communications.

I built a prototype from plumbing pipe and old bits of TV antenna to prove out the design. Later, I made an interesting discovery—the prototype's performance was a close match for the final version that I machined!

My final antenna basically consists of two parallel feeders of 1/2″ aluminum tube and five sets of elements of 1/4″ aluminum rod. You should be able to find this in any good hardware store. The feeders are held together with a fixed gap by nylon hardware and washers. (Sets of nylon hardware, sufficient for two antennas, are available for $4 from: Dave Koslow N2KLK, 3315 Hamilton Rd., Fairlawn NJ 07410.)

Clearly, here is a case where measurement, not material, is important. I have included data on various element and feeder diameters so you can build one out of what you have at hand.

Construction

You will need some basic metal working tools and skills. Later in this article I have included some alternative suggestions for construction using simpler techniques.

Cut the two boom sections to 27″. You will need a drilling jig and drill press to make accurate holes. I made up a block of wood, slightly longer than the boom section, with a "V" notch about 3/8″ deep down the long axis. Lay the boom section in the groove and

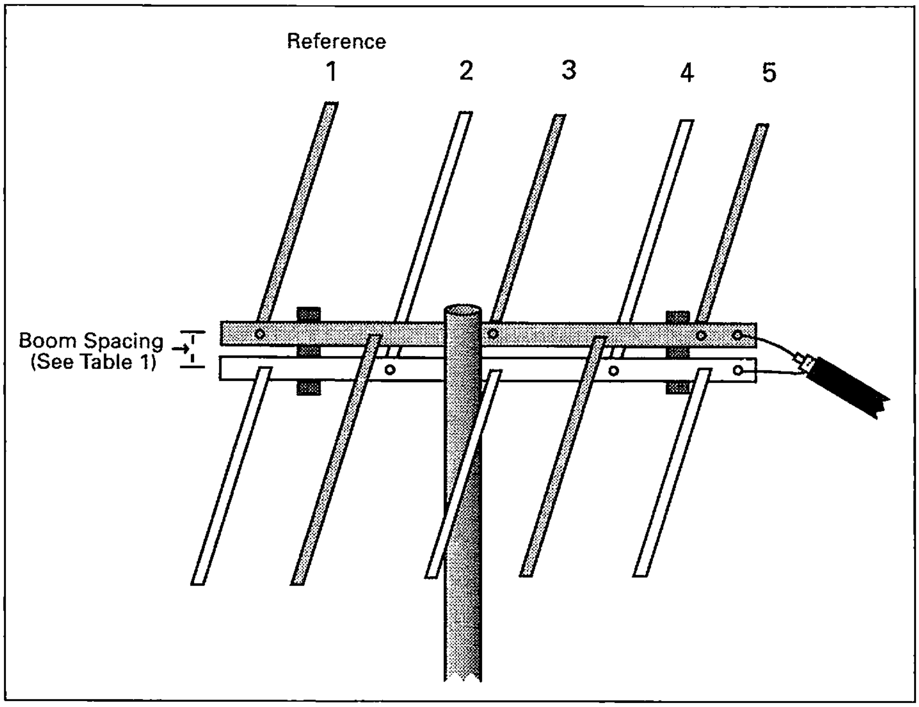


Figure 1. Construction details of the LPDA antenna. Note that the feedpoint is located ½" in front of the shortest element pair.

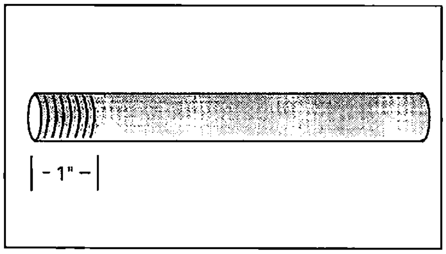


Figure 2. Cut each element 1-1/4" longer than shown in Table 1. Then cut a 1" length of screw threads on one end of each element using a 1/4-20 tap and die set.

scribe a line down its length with a pencil, using the block surface as a guide. This will be your drilling line.

Now rotate the tube so that the line is perpendicular to the block. Drill a small hole at each end of the boom section and secure the boom to the block with a small screw. Now lay out the hole spacing, starting with the first hole about 1-1/4" from an end. The measurements for hole spacing and element length are given in metric terms for greater accuracy. Mark each point with a center punch or hammer and nail to prevent drill skip. Drill and tap each hole for a 1/4-20 thread. These are for the elements to screw into. Drill a small hole, about 1/2" forward of the smallest element. This will be the feedpoint. Remove the boom from the jig, rotate 90 degrees, then secure it again with small holes and screws at the ends. Now drill three 1/4" clearance holes, at about 3", 13" and 23" from the longest element end. These are for securing the two boom halves. Repeat the process for the second section. Cut off the excess boom material, about 1/4" behind the longest element, and 1/4" in front of the feedpoint. Assemble the two boom sections together with nylon hardware and sufficient washers to provide the specified gap. The two halves must be insulated from each other, as they are the active parts of the feeder.

Cut each element about 1-1/4" longer than the finished size to allow for threading and tuning. Using a 1/4-20 die, cut about 1" of threads on one end of each rod element (see Figure 2). Put a nut on each element, spinning it down to the bottom of your threaded section, and tighten it in place with a wrench. In a LPDA, the feedpoint is at the front of the antenna, so the smallest element goes here. Each element half is screwed in to the boom, alternating top-left to bottom-right for the first element, top-right-to-bottom-left for the second, and so on (see the photos and Figure 1). This is to give a 180 degree phase shift to each pair. Attach a nut, finger-tight, to the element segment protruding from the boom. Measure each element length from the boom center and file or grind off the excess. Do the same with the threaded element past the nut. To attach the feedline, solder the conductor and shield to small brass washers and secure to the boom with brass hardware.

Specifications

Frequency range: 144–148 MHz
Gain: 9 dB
F/B ratio: 15 dB
Half-power beamwidth: 25 degrees
SWR: <1.5:1
Boom length: 25"
Longest element: 41+" (total)
Packed size: 25" x 1.5"

Finished Element Halves (2 of each)		Element Spacing
Element 1	52.44 cm (20.65")	Reference
Element 2	48.50 cm (19.10")	16.78 cm (6.61")
Element 3	44.86 cm (17.66")	15.52 cm (6.11")
Element 4	41.50 cm (16.34")	14.36 cm (5.65")
Element 5	38.39 cm (15.11")	13.28 cm (5.23")

Boom Spacing (Center-to-Center)	
0.500" boom & 0.250" element	0.614" spacing
0.500" boom & 0.375" element	0.652" spacing
0.625" boom & 0.250" element	0.767" spacing
0.625" boom & 0.375" element	0.815" spacing

Table 1. Log periodic dipole array specifications.

Alternatives

There are many ways to construct a LPDA. My two antennas were radically different in construction style and both work fine. In my prototype, the elements were 3/8" aluminum rolled tubes from an old TV antenna, held in to a copper tube boom with sheet metal screws. The boom insulators were PVC pipe welded together.

If you can't find aluminum tubing, 1/2" copper tubing works just fine. Because of the difference in diameter (it is really 0.625" o.d.), the antenna requires a different spacing of the boom halves. See Table 1 for the specifications. If you don't have access to metal shop tools, try contacting a local high school industrial arts shop. Surely a little fast talking (and maybe a ham radio demo) can get a few pieces threaded and drilled. You could also try using plain aluminum rod with speed nuts instead of threads. This will make portability a bit tough, though. Another possibility is threaded steel rod for the elements. Use your imagination—the dimensions and spacings are all that is critical.

Mounting is somewhat an individual thing, but there are some guidelines to follow. Because the whole antenna is active, it doesn't like metal masts too close. This is especially true with vertical polarization. You should have a nonconductive mast at least 10" beyond the longest element tip before a metal mast. I use a 3' PVC pipe on a small metal mast for backpacking DX. The antenna rests in a slot at the top and is held in place by a slotted PVC end cap. One end has a slot for vertical polarization; the other end is horizontal. This works pretty well for temporary setups. I haven't worked much on a permanent installation. Whatever you come up with, make sure you don't short the two boom halves together. If performance (or SWR) is poor, check that the elements are in proper order, and alternating left-to-right and top-to-bottom. It is very easy to make a mistake, so check carefully. This has "got" me several times in the hills.

I have had great success with this antenna, on repeaters and SSB, everywhere from mountaintops to my back yard. Try it. I think it will be the best portable antenna you've ever had. 73

Contact Dave Koslow N2KLK at 3315 Hamilton Rd., Fairlawn NJ 07410.

QRP Sidetone Companion

And part-time code practice oscillator.

by Charles D. Rakes KI5AZ

If you're a QRP enthusiast who enjoys building and operating small QRP transmitters, and you're doing so without the benefit of a built-in sidetone generator, take a look at our QRP Sidetone Companion and part-time code practice oscillator. This inexpensive, easy-to-build project can add a pleasant sidetone to almost any QRP transmitter, and serve double duty as a code practice oscillator for a soon-to-be ham.

Five transistors, a few capacitors and resistors, and an IC occupy a small PC board measuring 7/8" x 2-1/4". All of this along with an on/off switch, two phono jacks, a speaker, and a 9-volt battery, share space in a small plastic cabinet from Radio Shack. If you don't have a junk box to scrounge from, you can end up with ten dollars or less in the project by prudent component shopping.

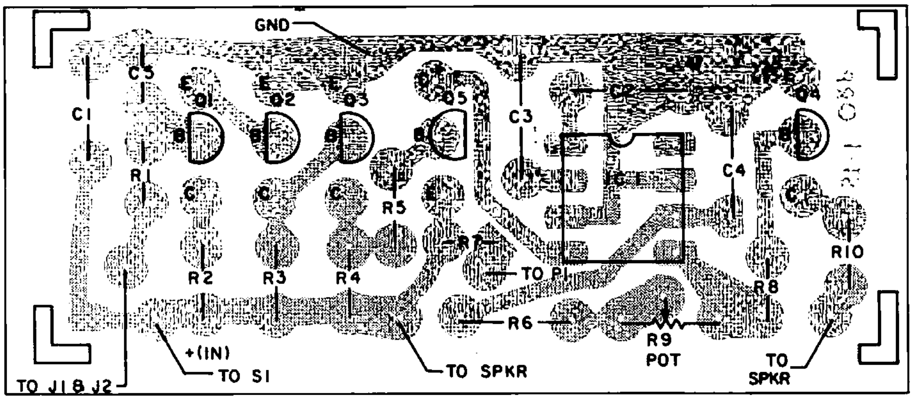


Figure 3. Parts placement.

The Inner Workings

To see how the circuit goes, take a look at the schematic diagram in Figure 1. The circuit is designed to operate with most any QRP transmitter that uses a positive keying voltage (most do). Two phono jacks are wired in parallel with the center conductors connecting to the base of Q1 through a 680k resistor. C5 eats any stray RF that might come in on the key leads. The positive keying voltage turns Q1 on. The emitter of Q1 is direct coupled to the base of Q2, turning it on also. Q3 is direct coupled to the collector of Q2, and when Q2 is on, Q3's base is clamped to near ground level, turning it off. With no current flow through R4, Q5 remains off.

By closing the key, the positive voltage at the base of Q1 disappears, turning Q1 and Q2 off; this allows Q3 and Q5 to turn on, bringing up the plus supply voltage to pin #4 of the 567 PLL IC. The 567, connected in an audio oscillator circuit, produces an audible tone signal that drives Q4. Q4's collector supplies audio to the speaker through a current-limiting resistor, R8. R9 sets the sidetone's frequency.

Three transistors are used in the front end to isolate the sidetone's circuitry from loading and falsely keying the QRP transmitter. For even greater isolation, R1 can be increased to 1 megohm. This will only be necessary if the sidetone circuit is used with a super-sensitive keying circuit—which isn't likely, but with Mr. Murphy lurking around every corner, anything is possible.

The part-time code practice oscillator is activated by inserting P1 into either J1 or J2, and a key in the remaining jack. If you like to fiddle with the sidetone's frequency, drill a 1/4" hole in the cabinet directly over R9, and adjust away.

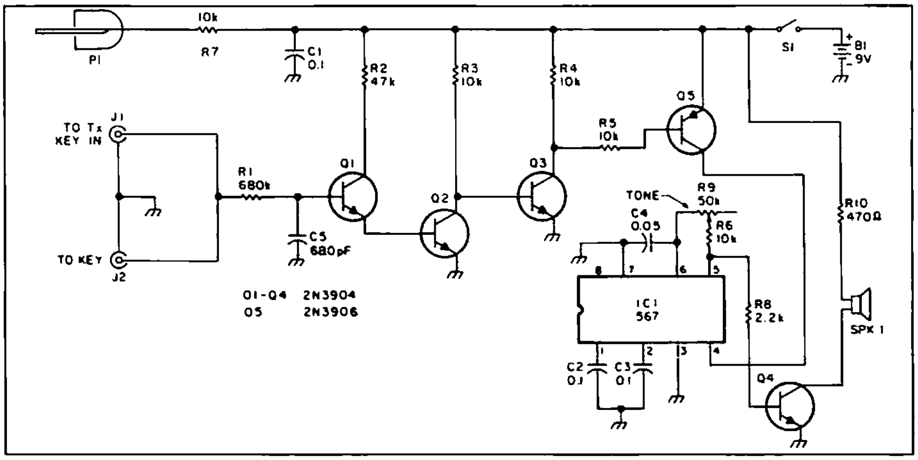


Figure 1. Schematic diagram of the Sidetone Companion.

Building the Sidetone Companion

The easy way is to use a PC board and follow the component placement drawing in Figure 2. As you position each part on the board, double-check its value and electrical location against the circuit diagram in Figure 1. In any case, the circuit is non-critical, and can be built breadboard style and housed in anything you like.

The circuit board is cut to slide into the groove in the side of the cabinet. The telephone headset (speaker) is located at one end of the cabinet, hot-glued in place. The power switch, the two phono jacks, and the plug are located along one edge of the cabinet. The battery fills the other end. Using the companion, plug the key into one of the jacks and run a jumper from the other jack to the "key" input of the transmitter. Flip S1 on, and hear what you are sending. Good QRPing!

Charles D. Rakes KI5AZ, P.O. Box 445, Bentonville AR 72712.

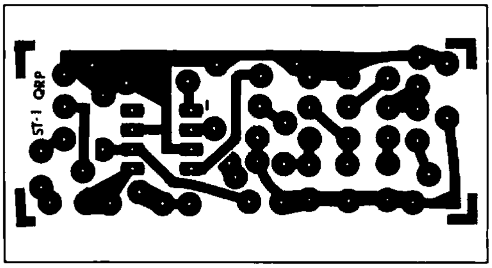


Figure 2. PC board foil pattern.

Parts list

B1	9-volt transistor battery	R8	2.2k 1/4W resistor
C1,2,3	0.1 µF 50-volt disc ceramic capacitor	R9	50k mini trim pot (vert)
C4	0.05 µF 100-volt mylar capacitor	R10	470-ohms 1/4W resistor
C5	680 pF 100-volt disc ceramic	S1	Mini SPST toggle switch
Q1,2,3,4	2N3904 NPN transistor	Spk-1	Headset removed from old telephone or a mini 8- or 16-ohm speaker
Q5	2N3906 PNP transistor	Misc.	Cabinet, wire, battery snap, hot glue, etc.
IC-1	567 PLL IC		
J1,2	Phono jacks		
P1	Phono plug		
R1	680k 1/4W resistor		
R2	47k 1/4W resistor		
R3,4,5,6,7	10k 1/4W resistor		

A printed circuit board and all of the parts for it are available for $8.95 plus $1.00 shipping from: KRYSTAL KITS, P.O. Box 445, Bentonville AR 72712. Tel. (501) 273-5340. You will need to furnish the cabinet, switch, jacks, plug, speaker, battery, and any part not on the PC board.

Number 7 on your Feedback card

The Copperback Beetle

A new type of "bug."

by Charles D. Rakes KI5AZ

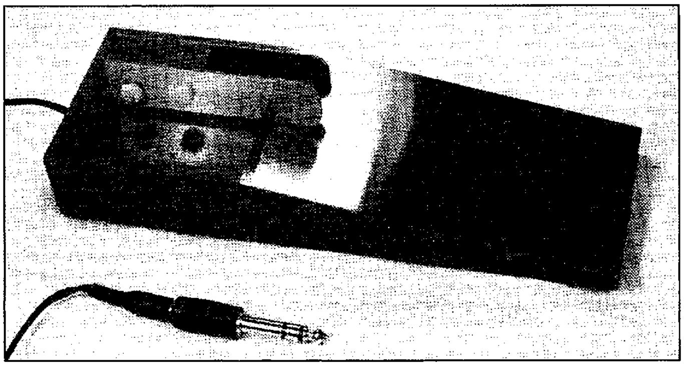


Photo A. The Copperback Beetle electronic bug.

In the May 1991 issue of *73 Amateur Radio Today*, I introduced the "Copperhead" keyer paddle that electronically replaces a mechanical paddle. Just a few days after the magazine came out, a fellow ham, Floyd Deen AA5QY, asked if I could design an electronic replacement for the cantankerous "Bug" keyer. Here are the results.

The "Copperback Beetle" performs like the famous Bug—happily generating dits automatically, with the last dit a twin of the first, no matter how many are in between. Also, the built-in dit generator is self-completing. Dahs are produced like the Bug—for as long as you like. And, like the Copperhead Keyer, the Beetle is touch-activated and will operate most commercial solid-state rigs with positive keying.

The Beetle is an excellent trainer for anyone who wants to learn to use the mechanical Bug because you can slow the dit maker to a snail's pace, or rack it up to a machine-gun-like speed. If you've been up to your Adam's apple with dits trying to master a Bug, then give the Copperback Beetle a shot. You might even like its feather touch.

Circuit Operation

Look at the Beetle's schematic diagram in Figure 1. See how few electronic components are needed to replace the many monkey-motion mechanical parts used in a typical bug. Also notice that an on/off switch isn't needed because the standby current is almost nonexistent. At rest, the battery will stay up for its normal shelf life.

The heart of the beetle is a single 4093 CMOS quad two-input NAND Schmitt trigger IC. The "dit" (left) paddle is connected to the input of gate "A" through a 100k resistor, and on to the positive voltage at the output of pin #10 of gate "C," through four series 10 megohm resistors. The minute current flow through the 40 megohm resistors holds the gate's input high. In standby the gate's output, pin #3, is low. When your skin resistance bridges the paddle-to-circuit ground, the gate's output goes positive, starting the dit generator, which is made up of gates "C" and "D." The self-completing function is accomplished when the output of gate "C" (pin #10) goes low, holding the dit input circuitry low for the time duration of the dit. The positive output at pin #11 of gate "D" passes through D2, turning on Q1 to activate the keyed output during the dit period.

The "dah" (right) paddle circuit operates in a similar manner, with the positive output at pin #4 of gate "B" passing through D1, switching Q1 on to supply a keyed output. A 39 pF capacitor at the input of both the "A" and "B" gates routes any stray RF to circuit ground.

Building the Beetle

The Beetle uses the very same hardwood base and paddle setup as the Copperhead keyer used (see Figures 2 and 3). The circuit can be constructed breadboard style or, to make the job easier, with a PC board. However you build it, take special care in handling and installing the CMOS chip.

Woodworks

Shape the keyer's base out of a hardwood block 3" x 8-1/2" x 1-1/4", as shown in

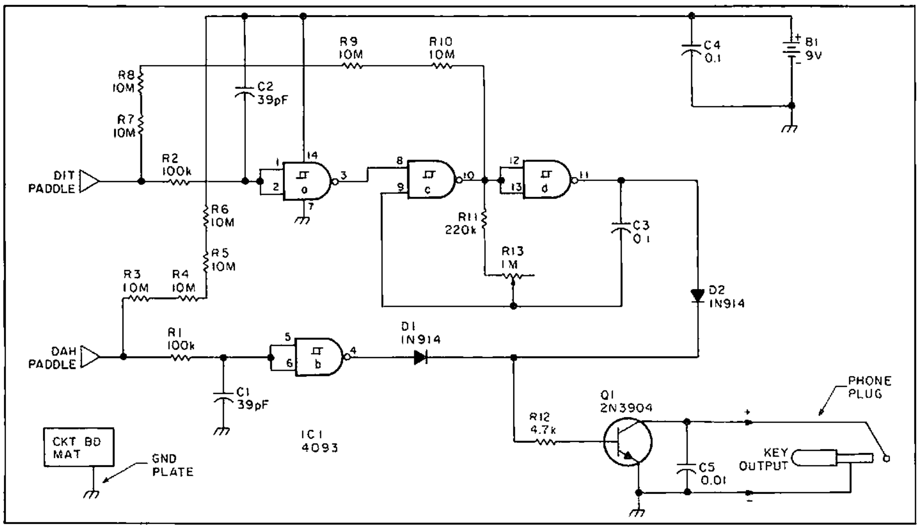


Figure 1. Schematic diagram.

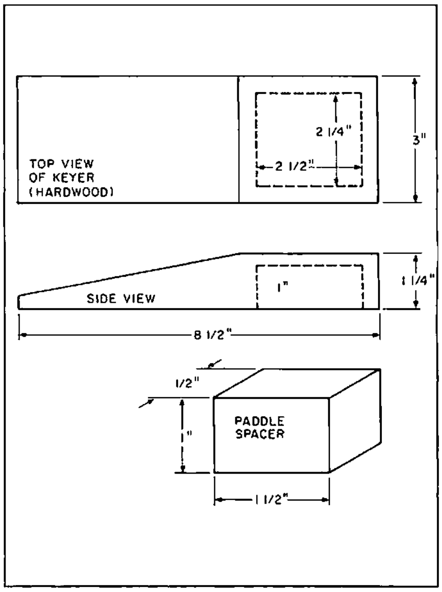


Figure 2. Keyer and spacer dimensions.

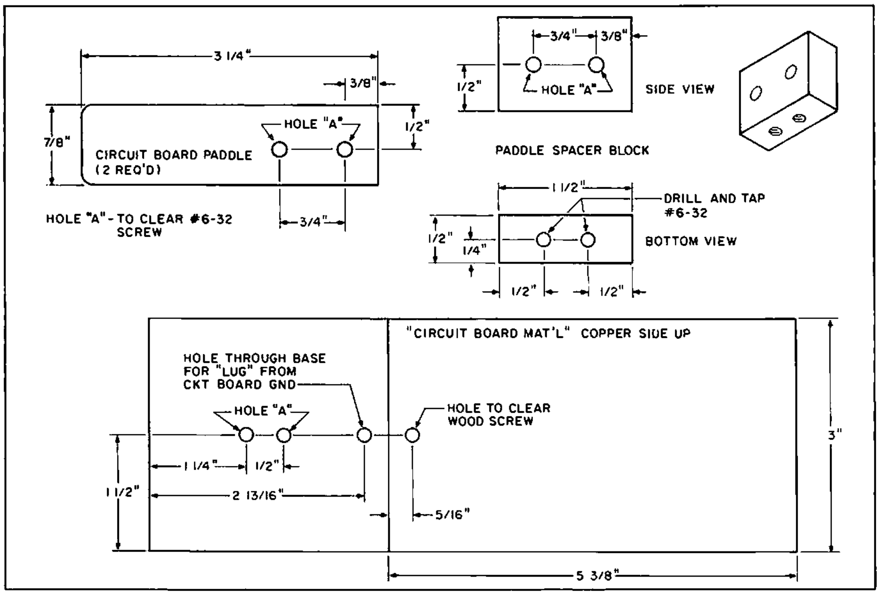


Figure 3. Paddle dimensions.

Figure 2. Carve a 2-1/2″ long by 2-1/4″ wide by 1″ deep cavity in the base to hold the circuit board and battery.

Cut a paddle spacer from the same hardwood material to the dimensions shown in Figure 2. Cut two paddles from circuit board material to the size and shape shown in Figure 3. Drill two holes in each paddle to match up with the two holes in the spacer block, then use a file or belt sander to round the corners of one end of each of the paddles. Smooth the edges with fine grit sandpaper.

Now you can drill the paddle mounting holes through the side of the spacer block as shown, and then drill two holes in the bottom of the spacer. Thread each for a 6-32 metal screw. Drill four holes in the base, then mount the spacer board in place with two 5/8″ 6-32 screws.

The grounding board, a section of circuit board 5-3/8″ x 3″, is mounted to the keyer's base with glue and a single wood screw. A long solder lug extends from the wood screw through a hole in the base (see photo of the completed key) to the cavity where it connects to circuit ground.

The paddles are mounted to the spacer with nylon 6-32 screws and nuts. A long solder lug on each paddle is secured by the nylon hardware and extends through the base connecting to the circuit, as shown in Figure 1.

Figure 5 shows the component side of the circuit board and the parts placement. Mount the parts as shown and solder them in place. Then connect the paddles, grounding pad, battery snap, and output plug wires to the circuit board.

Mount the circuit board, with the 1 megohm pot towards the back, to the inside of the cavity with two 1/4″ plastic spacers and wood screws. The battery is kept in place with an "L" bracket made from a spring steel 9 volt battery holder, and is mounted to the edge of the cavity with a wood screw.

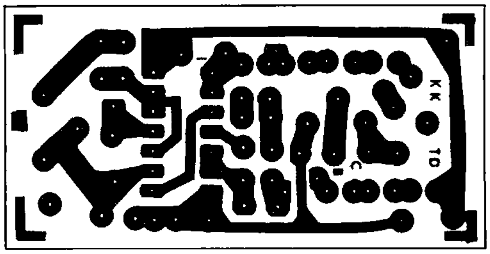


Figure 4. PC board foil pattern.

Checking the Beetle Out

With a battery in place, take a VOM in the RX-1 position and connect the positive lead (don't rely on red to mean positive; check it out) of the meter to the tip of the keyer's output plug, and the meter's negative lead to the common sleeve on the plug.

Position your wrist on the grounding pad and touch the "dit" (left) paddle. The meter should go from infinite resistance to approximately half-scale, and wiggle back and forth at the dit rate. Adjust R13 for the desired dit rate. Now touch the "dah" (right) paddle and the meter should go from infinite resistance to near zero. If so, you're ready to dit dah in style. ■

Contact Charles D. Rakes KI5AZ at P. O. Box 445, Bentonville AR 72712. Please enclose an SASE.

Copperback Beetle Parts List

B1	9-volt transistor battery
C1,C2	39 pF ceramic disc cap
C3,C4	0.1 µF ceramic disc cap
C5	0.01 µF ceramic disc cap
D1,D2	1N914 silicon diodes
IC-1	4093 quad 2-input NAND Schmitt trigger
Q1	2N3904 NPN transistor
R1,R2	100k 1/4 watt resistors
R3–R10	10 megohm 1/4 watt resistors
R11	220K 1/4 watt resistor
R12	4.7k 1/4 watt resistor
R13	1 megohm pot
Phono plug	mini or standard 1/4″
Misc.:	Hardwood material, circuit board material, battery snap, nylon hardware, solder lugs, wire, solder, etc.

You can buy a complete kit of parts, including a shaped base and spacer ready for stain or paint, paddles, hardware, circuit board, and all components, postpaid for $29.95 from Krystal Kits, P.O. Box 445, Bentonville AR 72712.

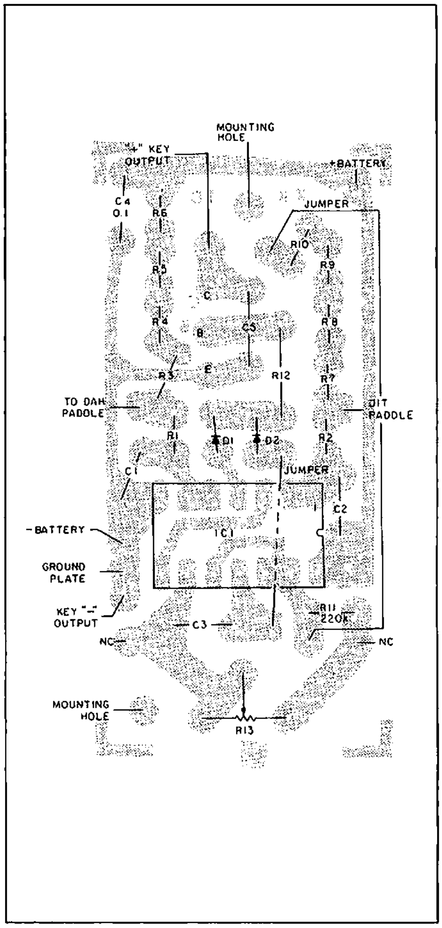


Figure 5. PC board parts placement.

73 Review

by Bill Clarke WA4BLC

The MFJ-247 Antenna Analyzer

SWR analyzer with a built-in frequency counter.

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State MS 39762
Telephone: (800) 647–1800
Price Class: $190

Last year I reviewed the MFJ-207 HF SWR analyzer from MFJ (see the January '91 issue, p. 18). It is an excellent device and it sure helped me set up my antenna system. This unit had a mechanical dial which gave me a good relative idea of the antenna's resonant point. However, to determine the exact resonant frequency, the user has to set up the unit by either beating a signal on a receiver or using an outboard frequency counter.

This was not a real problem for me, as I had a battery-operated counter and could plug it into the analyzer to get exact frequency readout. But suppose I didn't have a counter, or didn't want to carry two separate devices and their connection wires? Why not a combination unit that reads the SWR and frequency simultaneously? Well, that is exactly what MFJ has done with their model MFJ-247 HF SWR Analyzer.

What Is an SWR Analyzer?

The MFJ-247 is used to accurately find the SWR of an antenna at the shack feedline, the antenna, the tuner, or any point between. No RF signal is required from your transmitter.

The new analyzer is completely portable for field use, meaning no trips back to the shack to check SWR on your antenna. It provides a means for eliminating on-the-air tune-ups for setting up antennas, or when adjusting a tuner. Trimming and adjusting can be done at the same time measurements are made.

Using the MFJ-247 In the Field

Although the analyzer is very simple to operate, a quick read of the instruction manual is advisable. It won't take more than five minutes, as the instructions are clear and simple.

Using the analyzer for setting up a new 160 meter dipole, I initially figured the leg lengths of the dipole to be 126.5 feet each. I cut the legs a couple of feet over-size (a recommended practice). After assembly, the antenna was hauled into place. Connecting the analyzer to the feedline at the base of the tower, I selected the 1.8–2.9 MHz band (the other bands are 3.2–5.3, 6.5–11, 12–21, 18–30 with overrun on each). The tuning knob was slowly turned until the meter showed the lowest SWR point.

When the lowest point was located, I read the frequency from the LCD indicator, which showed 1.795 MHz. I brought the antenna down and trimmed some wire off each leg, raised it again, and rechecked the lowest SWR point. The readout was 1.846 MHz. Close enough!

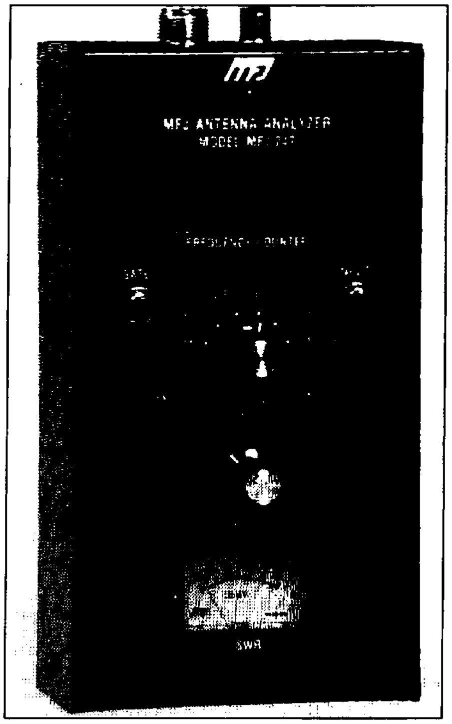


Photo A. The MFJ-247 digital SWR analyzer.

The dipole was put in place and tuned without returning to the shack. There were no on-the-air tune-ups. I merely connected the antenna's feedline to my remote antenna switch and was finished with my outside work.

Checking Feedlines in the Shack

I hooked the analyzer onto the feedline in my shack to assure that all was going to work as planned. A patch line was run from my transceiver selection switch to the SO-239 on top of the analyzer. I checked each antenna for exact the frequency of the lowest SWR, and made a notation in my station log.

If you are unsure of an antenna's SWR at a specific frequency, just tune the analyzer until it displays that frequency and read the SWR from the meter.

It is particularly interesting to make SWR plots of multiband antennas. Generally you will discover there are multiple points of low SWR, often where you may not expect them. Graph paper will help you make permanent records of the SWR plots of your antennas.

Adjusting a Tuner With the 247

You can use the SWR Analyzer as an aid in adjusting an antenna tuner without putting out a carrier on the air. By using a good quality self-grounding coax switch, you can select between the transmitter and the analyzer on the input side of an antenna tuner. Once selected, tune the analyzer to the frequency you will be transmitting on and adjust the tuner for the lowest SWR reading on the analyzer's SWR meter.

Just switch the feedline back to the transmitter and you are ready to operate. A word of warning: DO NOT TRANSMIT INTO THE ANALYZER or you will fry it!

Frequency Counter

The analyzer also functions as a frequency counter with up to six decimal places of display (i.e. 146.310025 MHz). This gives the MFJ-247 a dual purpose: an SWR analyzer and a frequency counter in one box.

I should note that the counter is not very sensitive, and, as is mentioned in the manual, the use of a "times 1" probe is recommended. For service work inside a transceiver this would be necessary, but for general frequency checking a rubber-duck on the top BNC connector is sufficient.

The manual has some good information about coax feedline losses and explains why high SWR can increase these losses. Also included is a sample SWR antenna plot chart, which can be copied.

My Recommendation

I enjoyed working on my antenna system with the original antenna analyzer and using the MFJ-247 just makes it easier since everything is inside one box.

Anyone working with antennas will find a use for the analyzer. It will be a real help for tuning a beam on top of a tower and setting the bands on a vertical. Also, the idea of "a no-carrier tune-up" is excellent.

Specifications

Dimensions: 4 x 7.5 x 2.5 inches (WHD)
Frequency: 1.75–33.5 MHz
Power: 12 VDC @ 300 mA
Batteries: 6 AA
Counter Sensitivity: 600 mV

Battery Watchdog

Keeps your battery up to snuff.

by Martin E. McCoy WBØTCZ/7

My station runs primarily from a 12 volt deep cycle battery under the shack, providing emergency power capability at a moment's notice. However, my 2 meter all-mode with a 170 watt linear drains the battery rapidly during my sessions as Net Control, and my other station equipment just adds insult to injury. With more 12 volt equipment planned, and my habit of forgetting to turn the charger on and off as needed to keep my battery fully (but not over) charged, I needed something to monitor my battery status and keep it charged.

With this in mind, I decided my battery watchdog should turn a charger on when the battery voltage drops below 11 volts, and turn it off when the battery voltage rises to 14 volts.

The parts for the watchdog are easy to find at Radio Shack, a discount store and a quick stop at a TV/stereo repair shop (or parts house). (See the Parts List.) If you refer to the schematic (Figure 1), my explanation of this circuit will make more sense.

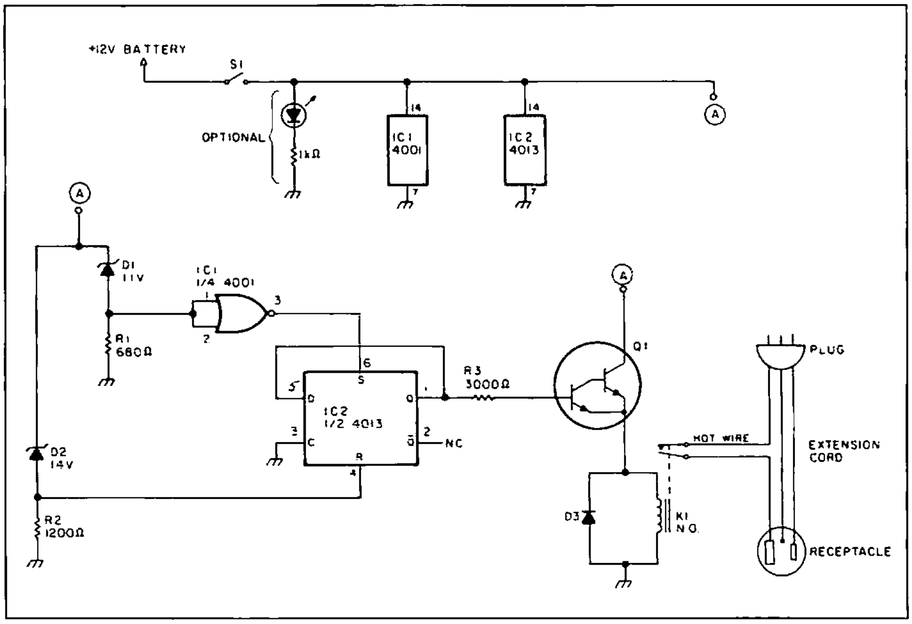


Figure 1. The schematic diagram of the battery watchdog.

Charger On

Zener diode D1 conducts as long as the battery voltage is over 11 volts. To maintain a stable voltage, this diode must conduct at least 11 mA, and since I don't want to draw more power than necessary, the series resistor of 680 ohms will keep the current down to a reasonable 16 mA. Since I wanted a high (logic 1) signal when the battery voltage drops below 11 volts, I used the 11 volt output from the zener regulator to drive one of the four gates in the 4001 CMOS quad's two-input NOR gate. By tying the two inputs to this NOR gate together, it functions as an inverter. Since it is a CMOS gate, it will operate directly from the 12 volt battery, and an 11 volt input won't harm it.

Charger Off

Zener diode D2 conducts when the battery voltage exceeds 14 volts. To maintain a stable voltage, D2 must conduct at least 8.9 mA, and since I don't want to draw more power than necessary, the series resistor of 1200 ohms will keep the current down to a reasonable 12 mA. Since this zener regulator provides the high (logic 1) output I want when the battery voltage exceeds 14 volts, no inverter is necessary.

Charger Control

One of the flip-flops in the 4013 CMOS dual D type flip-flop is used to turn the charger on and off. If the Q output is connected to the D (Data) input and the clock input is grounded, then it behaves as an R-S flip-flop. In other words, when a high (logic 1) is applied to the S (Set) terminal, Q goes high and remains there until a high is applied to the R (Reset) terminal, causing Q to go low (logic 0).

Operation

Assume that the flip-flop is off—that is, its Q output is low. With Q low, no current is supplied to the NPN Darlington Q1, it doesn't conduct and relay K1 is open, leaving the battery charger off.

When the battery becomes discharged, the voltage available drops below 11 volts. The regulator circuit containing D1 ceases to conduct, removing the input from IC1. Since IC1 is a NOR gate operating as an inverter, a lack of input causes the output to go high. Since this output is connected to the S (Set) input of IC2 (the flip-flop), the output Q goes high. This high output passes through R3 to keep the base current through Q1 to a reasonable value. Since Q1 is a Darlington transistor with a gain of at least 2500, this small current through the base is more than sufficient to allow the transistor to pass the 38 mA required to pull relay K1 in. When this relay is energized, the battery charger begins charging the battery.

When the battery charger starts charging the battery, the voltage available rises above 11 volts. This causes the regulator circuit containing D1 to begin conducting, supplying a high to the input of IC1. As you remember, IC1 acts as an inverter, so its output goes low, removing the high to the S (Set) input of IC2. But the output Q of the flip-flop remains high because the R (Reset) terminal is not receiving a high from the regulator circuit containing D2.

When the battery is fully charged, the battery voltage exceeds 14 volts. The regulator circuit containing D2 conducts, supplying a high to the R (Reset) input of IC2. When this happens, the flip-flop resets, output Q goes low and transistor Q1 stops conducting, releasing relay K1. The battery charger stops charging.

The diode across the coil of relay K1 clamps the voltage spike that occurs when

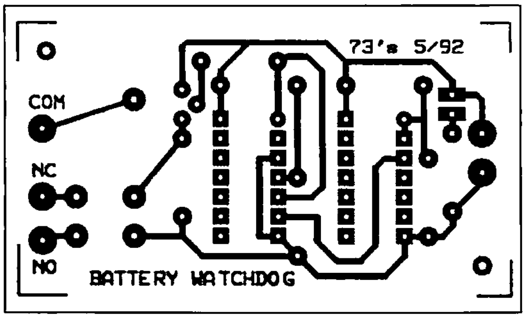


Figure 2. PC board foil pattern.

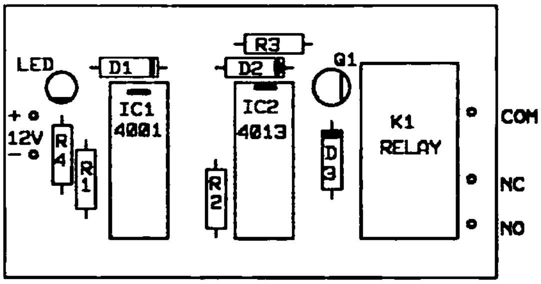


Figure 3. Parts placement.

Parts List

QTY	Part Number	Description
1	RCA SK11A/5020A	11 volt 0.5 watt zener diode
1	RCA SK14A/5023A	14 volt 0.5 watt zener diode
1	RS 276-2401	4001 CMOS quad two-input NOR gate
1	RS 276-2413	4013 dual-type D flip-flop
1	RS 276-2068	NPN Darlington transistor
1	RS 271-021	680 ohm 0.5 watt resistor
1	RS 271-024	1200 ohm 0.5 watt resistor
1	RS 271-028	3000 ohm 0.5 watt resistor
1	RS 276-1102	1N4003 rectifier
1	RS 275-624	SPST switch
1	RS 275-248	5A 125V relay 12 VDC coil
1	RS 270-233	Project box
1	N/A	3-wire extension cord

A blank PC board is available for $3 + $1.50 shipping from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

the transistor turns off. Without this diode the transistor has a short life!

Construction

I found that a perfboard and point-to-point wiring was a good way to construct this circuit. *[Ed. note: An etched and drilled PC board is also available.]* A hacksaw and a file trimmed my perfboard scrap to fit inside the metal box easily. I drilled holes in the box and the perfboard for mounting standoffs before beginning construction.

Try to arrange the components on the perfboard neatly. I find I make fewer mistakes this way, and it looks better, too. I passed the 12 volt power cord and the extension cord (both in and out) of the box using plastic crimp-style strain reliefs.

Tie all the inputs of all unused gates in both IC1 and IC2 to ground. For IC1 (the 4001 CMOS NOR gate), this would be the six unused inputs. For IC2 (the 4013 CMOS flip-flop) this would be the D, S, C and R inputs. If these inputs are left floating (not connected to ground), the two CMOS integrated circuits are very vulnerable to damage from static.

Mount the relay away from the other components on the board. Cut the extension cord in the middle, and pass the two ends through holes in the box. Connect the neutral and ground wires back together with either wire nuts or a careful solder job and insulating tape. This is 120 VAC at significant amperage you have available and it will do damage if you make a mistake, so **be careful!** Solder the hot wire to the Normally Open terminals of the relay. The same precaution applies here, so be careful! Secure the wires to the circuit board near where they are soldered to the relay so accidental movement doesn't twist them loose.

When wiring the switch in the circuit, you can add an LED and a series resistor (1000 ohms) if you want a power indicator.

When you place the perfboard in the box, examine the area between the bottom of the circuit board and the box for any possible shorts. I neglected to do this and was rewarded by an impressive display of sparks!

If you have problems with RFI from your transmitters, ground the metal case. Add a toroid coil in series with both the positive and negative DC power leads. Bypass this coil to ground with a ceramic capacitor (0.01 µF). An electrolytic across the DC input will also help. Additional bypassing may be needed on the extension cord. Ceramic capacitors (0.01 µF) will help here, too.

My battery watchdog has worked quite well, and I don't worry about a dead battery or scrambling to plug the battery charger in during a session as net control.

I want you to be aware that a charging lead-acid battery produces a sufficient amount of hydrogen to cause a very damaging explosion. My battery is not in the shack, but under my home, vented to the outside. Two AWG 00 cables bring DC into my shack with very little voltage drop (0.5 volt measured at 40 amps).

Now when the power goes off in the middle of the sweepstakes or during a rare DX contact, you can just smile and keep hamming!

Control Your Station by Computer

Hardware and software interfaces for Kenwood rigs.

by F. Barry McWilliams WK2S

Computers are finding their place in ham radio shacks in ever-increasing frequency. They are being used to replace paper logs for both general operation and, especially, for contest operation. They are being used as word processors to produce club newsletters. They are being used for learning CW, and there are programs available that tutor you in the theory and regulations for different grades of ham licenses. They are being used for all sorts of complex calculations, such as Minimum Usable Frequency (MUF), great circle beam headings and distance, Smith charts, antenna patterns and circuit analysis. The next step is the use of the computer for actually controlling your station.

Though often unseen by their users, computer control is commonplace in many VHF repeater installations. A microcomputer, not unlike the one in your desktop computer, controls the repeater's transmit, receive and identification functions. However, unlike the desktop computer, the repeater control computer runs only one program, the program that controls the repeater.

This article examines the hardware and software interfaces that make it possible to control your HF station with your IBM-compatible desktop computer. The major ham radio manufacturers each offer computer control for some of their HF and VHF transceivers. Here we'll look at the hardware and software interface provided by Kenwood for computer control of the following models:

- TS-140S
- TS-440S
- TS-940S
- TS-950S
- TS-711S
- TS-811S
- R5000

First, we will examine the hardware interface between the computer and the radio. Then we will discuss how a computer program can control the operation of the radio by taking a look at some sample segments of BASIC code.

Hardware Interface

The hardware interface between the radio and your computer is a straightforward RS-232C serial interface, not unlike your computer's interface to a telephone modem or a packet TNC. The Kenwood transceivers require an interface kit that is installed in the transceiver, and a level converter unit, IF-232C, that comes as a separate unit with cables that connect to your computer and to your radio. Figure 1 shows the hardware configuration for the TS-940S.

Photo A. Easy computer control of your rig is possible with this simple interface.

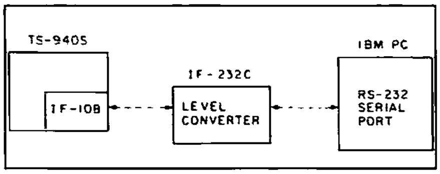


Figure 1. TS-940S-to-PC configuration.

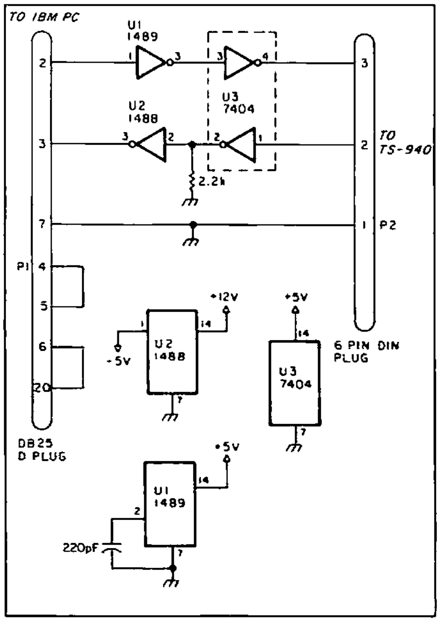


Figure 2. TTL/RS-232 level converter. Integrated circuits: U1 MC1489 RS232 quad line receiver (Radio Shack 276-2521); U2 MC1488 RS232 quad line driver (Radio Shack 276-2520); U3 7404 hex inverter (Radio Shack 276-1802). Miscellaneous: P1 - 25-pin female type D plug (Radio Shack 276-1548); P2 - 6-pin DIN plug (Radio Shack 274-020).

The IF-10B computer interface kit is installed in the TS-940S, and the output of the computer interface is available at the ACC1 accessory connector on the rear panel of the TS-940S. The signals at the ACC1 connector are TTL logic levels, 0 and +5 volts. The IF-232C level converter converts the TTL signals to RS-232 standard levels required for use with the serial IO ports on IBM and compatible PCs.

There are different interface kits for various models of the Kenwood radios. You should check with a Kenwood dealer to be sure you have the interface kit that matches your particular radio. The IF-232C level converter is the same for all of the Kenwood radios. You can build your own IF-232C and save a bit of money over the Kenwood accessory.

A home-brew converter is shown in Figure 2. It consists of only three integrated circuits: a TTL inverter (7404), a TTL-to-RS-232 level converter (1488) and a RS-232-to-TTL converter (1489). I built this circuit on a Radio Shack perf board using sockets for the ICs and small gauge (wire wrap) wire for connections.

The power supply requirements are minimal:

- +5 volts is required for the 7404 TTL logic IC and the converter chips.
- +9 to +12 volts can be used for the positive RS-232 level.
- −5 to −12 volts can be used for the negative RS-232 level.

The positive and negative RS-232 levels do not need to match one another. I used a Coleco game power pack that supplied +5, +12 and −5 volts.

Software Interface

The PC communicates with the radio by means of commands sent to the radio as a string of characters. For example, if the com-

puter sends the following string to the radio: FA00014300000; then the frequency of VFO A is set to 14.300 MHz. Some commands elicit a response from the radio to the PC. For example: IF; requests the radio to send a report of its current settings to the PC. The radio responds with a string of data that includes the current frequency, RIT and XIT frequency, the operating mode (USB, LSB,CW), and so forth.

	Interface Kit	Level Converter
TS-940S	IF-10B	IF-232C
TS-950S	built-in	built-in
TS-440S, TS-680S, R-5000	IC-10	IF-232C
TS-140S	IF-10C	IF-232C
TS-711A, TS-811A	IF-10A	IF-232C
TS-711A	IF-10A	IF-232C
TS-790A	(none) built-in	IF-232C

Table 1. Interface kit and level converter matches for Kenwood radios.

Because the BASIC programming language is practically the lingua franca of personal computer languages, I will use some simple fragments of BASIC code to illustrate how you can control your radio from your computer. At the end of this article, we will put all the fragments together to form a rudimentary program that allows you to send control commands to your radio and receive status returned from the radio.

PC-Radio Communications

The first order of business is to get the PC and the radio talking to one another. The radio interface always communicates at a particular speed and data format; the Kenwood interface is set to 4800 baud and 8 data bits. The BASIC OPEN statement initializes the PC for serial communication as shown below:

```
510 OPEN "COM2:4800,N,8" AS #1 ' OPEN COM
  port 2
520 COM(2) ON
```

These statements initialize PC communications port 2. To initialize port 1, change the number, 2, in each of the above statements to 1.

Handling Asynchronous Input From the Radio

The Kenwood radios communicate with the PC by sending a series of characters to the PC. A complete string of characters is ended with a semi-colon (;). The PC program must be able to process each character as it arrives from the radio and store the characters until a semi-colon comes along.

The BASIC ON statement enables us to write code that is executed each time a character comes along. The ON statement illustrated below routes control to a subroutine at statement 5000. The subroutine:

- saves the character from the radio,
- looks for a semi-colon meaning the end of input,
- sets the variable L to 1 when a semi-colon is found.

```
100 ON COM(2) GOSUB 5000 ' setup for COM port 2
  interrupts
```

```
Command
----------

ID;                Returns id of radio.
                    ID003; for TS940
                    ID004; for TS440
                    ID005; for R5000

FAggmmmkkkhhh;     Set VFO A frequency.  Where gg = gigahertz,
                   mmm = megahertz, kkk = kilohertz ahd
                   hhh = hertz.  All the values must be specified,
                   so to set the VFO A to 7.335 MHz, enter
                   FB00007335000;

FBggmmmkkkhhh;     Set VFO B frequency.

FA;                Read VFO A's frequency.
                   You should see a response from the radio that
                   looks much like the Set VFO A frequency command.
                   The response will be of the form, FAggmmmkkkhhh,
                   and can be interpreted in the same manner as the
                   SET VFO frequency command.

FB;                Read VFO B's frequency.

IF;                Read radio information.
                   The response from the radio is 35 bytes long and
                   of the form, IFggmmmkkkhhheeeeeSKHHHrxbNNtMfcp----;

                   ggmmmkkkhhh .. display frequency, gg,mmm.kkkhhh MHz
                   eeeee ........ step frequency, ee,eee Hz
                   S ............ plus(+) or minus(-) RIT/XIT direction
                   KHHH ......... RIT/XIT frequency, k.hhh KHz
                   r ............ 0 if RIT is off, 1 if RIT is on
                   x ............ 0 if XIT is off, 1 if XIT is on
                   b ............ memory bank number (TS-940)
                   NN ........... memory number
                   t ............ 0 if transmitter on,
                                  1 if transmitter off
                   M ............ 1 if LSB,  2 if USB
                                  3 if CW,   4 if FM
                                  5 if AM,   6 if FSK
                   f ............ 0 if VFO A
                                  1 if VFO B
                                  2 if memory
                   c ............ 0 if scan off, 1 if scan on
                   p ............ 0 if split off, 1 if split on
                   ---- ......... blanks (not used)

AI1;               Turn auto-information on.
                   Whenever any radio function is changed, the IF
                   information (see above) is sent to the computer.

AI0;               Turn auto-information off.

FN0;               Select VFO A
FN1;               Select VFO B
FN2;               Select memory (VFO/Mem)

MCbmm;             Select memory bank b, channel mm

DN;                Step VFO frequency or memory channel down one step.
UP;                Step VFO frequency or memory channel up one step.

LK0;               Frequency Lock off
LK1;               Frequency Lock on

MD1;               Select LSB
MD2;               Select USB
MD3;               Select CW
MD4;               Select FM
MD5;               Select AM
MD6;               Select FSK

RT0;               RIT off
RT1;               RIT on
XT0;               XIT off
XT1;               XIT on
RD;                Tune RIT/XIT down 10 Hz
RU;                Tune RIT/XIT up 10 Hz
RC;                Clear RIT/XIT

RX;                Receive (transmit off)
TX;                Transmit

SC0;               Program scan off
SC1;               Program scan on
MS0;               Memory scan off
MS1;               Memory scan on
HD0;               Scan hold off
HD1;               Scan hold on

SP0;               Split off
SP1;               Split on

AT;                Antenna tuner

LO;                enable remote control of slope tune and VBT (TS-940)
SH;                read Slope tune high
SHvv;              set Slope tune high. vv is a value between 00 and 31
SLvv;              read Slope tune low
SLvv;              set Slope tune low. vv is a value between 00 and 31
VB;                read VBT
VBvv;              set VBT. vv is a value between 00 and 31

MR bNN;            Read memory.
                   b is memory bank
                   NN is memory channel

                   This command returns the data in the selected
                   memory in the form, MR bNNggmmmkkkhhhM-----;
                   M is the mode (LSB, USB, etc.) with the same
                   values as M in the IF response, above.

MW bNNggmmmkkkhhhM-----; Write memory
                   b is memory bank
                   NN is memory channel
                   ggmmmkkkhhh is the frequency
                   M is the mode (LSB, USB, etc.) with the same
                   values as M in the IF response, above.

VR;                Voice recall
DI;                DCL ID readout of call sign
DS1;               DCL on
DS0;               DCL off
OS;                Offset
ST;                Tone number step
```

Table 2. Radio commands. The commands you can issue and the response you should expect back from the radio.

```
5000 REM - process characters from COM Port
5060 IF EOF(1) THEN RETURN
5070 C$=C$+INPUT$(LOC(1),#1)
5080 IF INSTR(C$,";")=0 THEN GOTO 5060 ' semi-
  colon means end-of-data
5090 L=1:CI$=C$:C$="  ' Set L=1 and put the
  data in CI$
5110 RETURN    ' for later use.
```

Sending Commands to the Radio

Control commands are sent to the radio by means of the BASIC PRINT statement. The following subroutine asks the user to enter a radio command and then, at line 8060, sends the command to the radio. Line 8060 takes the user input in the variable A$ and does a PRINT #1 to send the command to the serial communications port. The semi-colon (;) in line 8060 is needed to tell BASIC that a carriage return character should not be sent to the radio at the end of the PRINT string.

```
8000 REM - Enter a radio command
8010 PRINT "Enter command = = = > ";   ' prompt
  user for command
8040 LINE INPUT A$    ' input command from user
8050 IF A$=" THEN RETURN
8060 PRINT #1,A$;    ' send command to radio
8910 RETURN
```

We need a way to get to this code so the user can enter a command. This can be done by setting up a function key so that this routine is called whenever the function key is pressed.

```
650 ON KEY(3) GOSUB 8000    ' setup F3 key
652 KEY 3,"Cmd "
660 KEY(3) ON
```

Main Program

The main program will spend all of its time simply waiting for input from the radio or the user.

```
1000 REM - Main Program loop
1020 IF INKEY$=CHR$(27) THEN STOP    ' Esc key
  pressed ... STOP
1100 IF L=1 THEN GOSUB 6000:L=0: GOTO 1020
  ' Data from radio ... display
1190 GOTO 1020
```

Line 1020 uses the BASIC INKEY function and tests to see if the user has pressed the Escape key. If so, the program will stop.

Line 1100 tests the variable L which is set in the radio input subroutine when a semicolon is found (see line 5090, above). L=1 means that a complete line has been received from the radio. The main program calls the routine at line 6000 to display the data received from the radio.

Line 1190 routes control back to be top of the main program loop.

Display of Data from the Radio

For our simple program, the subroutine to display data received from the radio will just print the data saved in CI$.

```
6000 REM - display data from Radio
6010 PRINT CI$    ' Display CI$ to see what we got.

6350 RETURN
```

Or, you can use the following code that illustrates how you might extract the data returned from the IF; command.

```
6000 REM - display data from Radio
6010 PRINT CI$    ' Display CI$ to see what we got.
6020 IF MID$(CI$,1,2)>"IF" THEN RETURN ' is this
  an IF response?
6030 RIT=VAL(MID$(CI$,24,1))   ' sort out data in
  response
6040 XIT=VAL(MID$(CI$,25,1))
6050 MC=VAL(MID$(CI$,27,2))
6060 XMIT=VAL(MID$(CI$,29,1))
6070 MODE=VAL(MID$(CI$,30,1))
6080 FUNC=VAL(MID$(CI$,31,1))
6090 SCAN=VAL(MID$(CI$,32,1))
6100 SPLIT=VAL(MID$(CI$,33,1))
6110 MHZ=VAL(MID$(CI$,6,2))
6111 KHZ=VAL(MID$(CI$,8,3))
6112 HZ=VAL(MID$(CI$,11,3))
6120 PRINT " Freq: ";
6132 PRINT MID$(CI$,6,2);".";' MHz
6133 PRINT MID$(CI$,8,3);",";' kHz
6134 PRINT MID$(CI$,11,3); ' Hz
6140 IF RIT THEN COLOR 7,4:PRINT " RIT
  ";:COLOR 7,0 ELSE PRINT " ";
6150 IF XIT THEN COLOR 7,4:PRINT " XIT
  ";:COLOR 7,0 ELSE PRINT " ";
6160 IF (RIT+XIT)=0 THEN COLOR 7,0 ELSE
  COLOR 0,7 ' reverse if XIT or RIT
6170 PRINT MID$(CI$,19,1);"
  ";MID$(CI$,20,1);".";MID$(CI$,21,2);
6180 COLOR 7,0
```

Complete program

```
100 ON COM(2) GOSUB 5000        ' setup for COM port 2 interrupts
510 OPEN "COM2:4800,N,8" AS #1  ' OPEN COM port 2
520 COM(2) ON
650 ON KEY(3) GOSUB  8000                 ' setup F3 key
652 KEY 3,"Cmd    "
660 KEY(3) ON
1000 REM - Main Program loop ---------------------------------------
1020 IF INKEY$=CHR$(27) THEN STOP         ' Esc key pressed ... STOP
1100 IF L=1 THEN GOSUB 6000:L=0:GOTO 1020 ' Data from radio ... display
1190 GOTO 1020
5000 REM - process characters from COMM Port ------------------------
5060 IF EOF(1) THEN RETURN
5070 C$=C$+INPUT$(LOC(1),#1)
5080 IF INSTR(C$,";")=0 THEN GOTO 5060 ' semi-colon means end-of-data
5090 L=1:CI$=C$:C$=""                  ' Set L=1 and put the data in CI$
5110 RETURN                            ' for later use.
6000 REM - display data from Radio ---------------------------------
6010 PRINT CI$                         ' Display CI$ to see what we got.
6020 IF MID$(CI$,1,2)<>"IF" THEN RETURN ' is this an IF response?
6030 RIT=VAL(MID$(CI$,24,1))            ' sort out data in response
6040 XIT=VAL(MID$(CI$,25,1))
6050 MC=VAL(MID$(CI$,27,2))
6060 XMIT=VAL(MID$(CI$,29,1))
6070 MODE=VAL(MID$(CI$,30,1))
6080 FUNC=VAL(MID$(CI$,31,1))
6090 SCAN=VAL(MID$(CI$,32,1))
6100 SPLIT=VAL(MID$(CI$,33,1))
6110 MHZ=VAL(MID$(CI$,6,2))
6111 KHZ=VAL(MID$(CI$,8,3))
6112 HZ=VAL(MID$(CI$,11,3))
6120 PRINT "  Freq: ";
6132 PRINT MID$(CI$,6,2);".";   ' MHz
6133 PRINT MID$(CI$,8,3);",";   ' kHz
6134 PRINT MID$(CI$,11,3);      ' Hz
6140 IF RIT THEN COLOR 7,4:PRINT " RIT ";:COLOR 7,0 ELSE PRINT "     ";
6150 IF XIT THEN COLOR 7,4:PRINT " XIT ";:COLOR 7,0 ELSE PRINT "     ";
6160 IF (RIT+XIT)=0 THEN COLOR 7,0 ELSE COLOR 0,7  ' reverse if XIT or RIT
6170 PRINT MID$(CI$,19,1);" ";MID$(CI$,20,1);".";MID$(CI$,21,2);
6180 COLOR 7,0
6200 PRINT " Mode: ";
6210 IF MODE=1 THEN PRINT "LSB";
6220 IF MODE=2 THEN PRINT "USB";
6230 IF MODE=3 THEN PRINT "CW ";
6240 IF MODE=4 THEN PRINT "FM ";
6250 IF MODE=5 THEN PRINT "AM ";
6260 IF MODE=6 THEN PRINT "FSK";
6300 PRINT " Function: ";
6310 IF FUNC=0 THEN PRINT "VFO A     ";
6320 IF FUNC=1 THEN PRINT "VFO B     ";
6330 IF FUNC=2 THEN PRINT "Memory ";:PRINT MC;
6340 PRINT
6350 RETURN
8000 REM - Enter a radio command -------------------------------------
8010 PRINT "Enter command ===> ";          ' prompt user for command
8040 LINE INPUT A$                         ' input command from user
8050 IF A$="" THEN RETURN
8060 PRINT #1,A$;                          ' send command to radio
8910 RETURN
```

The complete interface and control program.

```
6200 PRINT " Mode: ";
6210 IF MODE=1 THEN PRINT "LSB";
6220 IF MODE=2 THEN PRINT "USB";
6230 IF MODE=3 THEN PRINT "CW ";
6240 IF MODE=4 THEN PRINT "FM ";
6250 IF MODE=5 THEN PRINT "AM ";
6260 IF MODE=6 THEN PRINT "FSK";
6300 PRINT " Function: ";
6310 IF FUNC=0 THEN PRINT "VFO A  ";
6320 IF FUNC=1 THEN PRINT "VFO B  ";
6330 IF FUNC=2 THEN PRINT "Memory ";:PRINT
  MC;
6340 PRINT
6350 RETURN
```

Running the Program

If the above program lines are combined, you have a complete BASIC program that can control your Kenwood radio. You will need to choose the proper communications port number (1 or 2) in lines 100, 510 and 520. When you run the program, press the F3 key and you will be prompted to enter a radio command. First try the ID; command. You should see a line displayed on your computer display which is the response from the radio. The ID command response should look like "ID00n;", where n is a number that corresponds to the model of your radio (for example, ID003 is returned by a TS-940.) Next, try the AI1; command. This command will cause the radio to report its status whenever a change is made. After entering the AI1; command, turn the radio tuning dial, and you should see the response displayed on your computer screen.

A description of the radio commands appears at the end of this article.

RFI

Computers in the ham shack have been notorious for causing interference to the ham receiver. I have had the opportunity to use an original model IBM PC, an IBM PCjr and an IBM PC Convertible (laptop) in my shack. Each of these PCs has caused some interference, but I've found that the interference is reduced to an acceptable level by:

- use of shielded cables for antenna connections, and
- separation of the radio antenna from the computer.

In other words, the proximity of the antenna to the computer is more significant than the pickup of interference from computer interconnections to its keyboard, display or other outboard computer accessories.

I could detect no increase in interference when I connected the PC to the TS-940S as described, even with the simple home-brew level converter. When the radio sends information to the PC, there may be a slight, detectable signal for a brief fraction of a second as the computer reads and processes the serial data stream.

What Else Can You Do?

The hardware interface described in this article is complete, but the software only scratches the surface of what you can do. I encourage you to use the program to experiment with how your radio accepts and responds to commands. Once you have a feel for how this software works, you can use it as the basis for:

- a logging program that gets frequency and mode data directly from your radio,
- a program that stores station call and frequency information for SWL stations on PC disk,
- a contest program that stores frequency information for stations you've heard but want to return later to contact,
- a satellite program that calculates satellite passes and tunes your radio—and even, with some additional hardware, positions your antennas,
- a packet program that allows you to select the frequencies of HF and VHF bulletin boards, and
- programs that only you can imagine as you use the power of your computer and radio to enhance your favorite modes of ham radio operation.

Number 11 on your Feedback card

73 Review

by Dick Goodman WA3USG

LOGic Jr. and LOGic II Vers. 2.1 Ham Logging Software

Discover the versatility of a computerized logbook.

Personal Database Applications
2616 Meadow Ridge Dr.
Duluth GA 30136-6037
Telephone: (404) 242-0887; Fax: (404) 449-6687
Price Class: LOGic Jr. $39; LOGic II Vers. $79.

LOGic Jr. and LOGic II from Personal Database Applications are state-of-the-art integrated database management systems dedicated to amateur radio logging. LOGic Jr. is the entry level program and will enable the user to get started with his or her logging requirements. This review will cover the major aspects of both as used on the IBM-PC. LOGic is also written for the Commodore Amiga and the Atari ST. The user's manual also states that a Mac version will soon be available.

The LOGic logging system is extremely user friendly. Even the uninitiated computer user will be able to start basic logging within a few minutes after installation. As knowledge of the system increases, virtually any type of logging function imaginable can be implemented. Supported functions of LOGic Jr. include:

1. Logging in real time (auto entry of date/time) and non-real time;
2. Auto logging of data from previous QSOs;
3. Automatic tracking of virtually any award;
4. QSL management;
5. User-definable fields in the log;
6. Extremely versatile print function, prints log reports, awards progress, beam headings, QSL Cards and labels;
7. Up to 20 pages of free-form notes/comments stored per QSO.

If LOGic II is purchased, the following functions are included:

1. Interface capability to most computer controlled rigs; logs mode, frequency and band;
2. Control of the radio with full screen memory display;
3. Auto duping and scoring for almost any contest including user generation of contest parameters;
4. Menu-driven report writer, enabling design of your own customized printouts, labels, and QSL cards;
5. QSL database manager facility;
6. Grayline propagation chart;
7. Control of any antenna rotor with RS-232 interface capability.

Some Background

The LOGic logging system was written in "DBMAN," a commercially available applications development system. This system is used by many large corporations and government agencies for the creation of large integrated database management applications used in PC environments. Using a system such as this keeps the developer from "re-inventing the wheel" because many subroutines and functions are included with the development system and do not have to be written "from scratch." Since these functions are utilized in programs written by different developers, they are proven reliable many times over. I have seen programs, logging and otherwise, that did not execute reliably because they were not tested adequately! Since I write software for a living myself, I feel that those with a good degree of computer literacy will find this an important factor in deciding whether or not to purchase any software package.

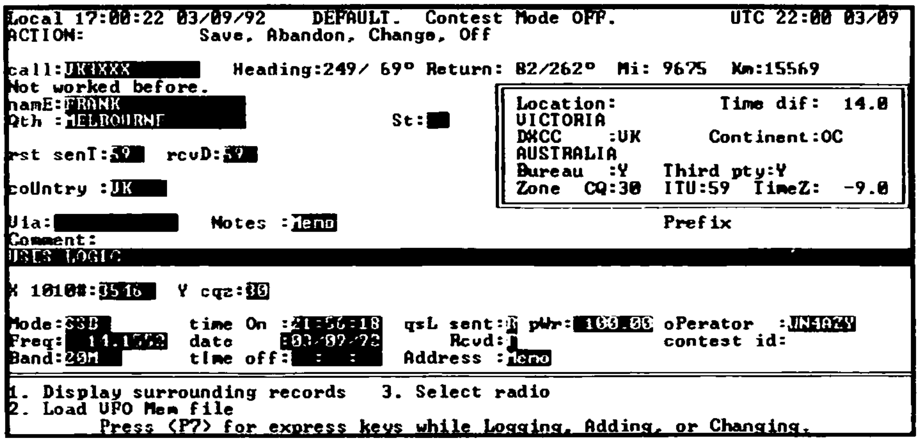


Photo A. LOGic's logging screen. This is only one of many possible configurations.

Incidentally, some of the DBMAN commands and functions are available for use even if you don't have a copy of the DBMAN language. This will allow extensive global updating and diverse manipulation of your database. Be careful, however, because some commands, such as "ZAP," will totally erase a database in one fell swoop! Ensure that your database is backed up before you experiment, but by all means experiment. This is one system that is limited only by your imagination!

Installation

The IBM version of the LOGic system may be ordered on any IBM compatible media (360K, 720K, 1.2M, or 1.44M disks). I received mine on two 1.2M floppy disks. The system requires a hard drive to run. The "LOGic Main Disk" has the installation file on it. You are required to make a directory on your hard drive where the LOGic system will reside, and then to run the installation program. The documentation is excellent. With LOGic II, two manuals are provided. The first is approximately 80 pages long and covers all aspects of installation and use of LOGic Jr. and LOGic II. The second manual is applicable to the "Report Writing" function of LOGic. Both documents are high quality, desktop published manuals with the camera ready copy being at least laser-print quality. These manuals are the highest quality software documentation that I have reviewed to date! Finally, LOGic requires 450K of free memory to execute.

Installation on my 80286-based machine went smoothly and was precisely documented in the user's manual. After installation, a series of menus are presented. These allow the setting of station parameters such as callsign, location (latitude and longitude), offset to UTC, screen colors, screen configuration, and selection of fields that you want to have a default value in your log. Once these parameters are installed, you can begin logging.

Operation

Using this system is as easy as entering the logging screen from the main menu and typing in the information. I found the default data entry screen to be well designed and quite striking in its layout. When a callsign is en-

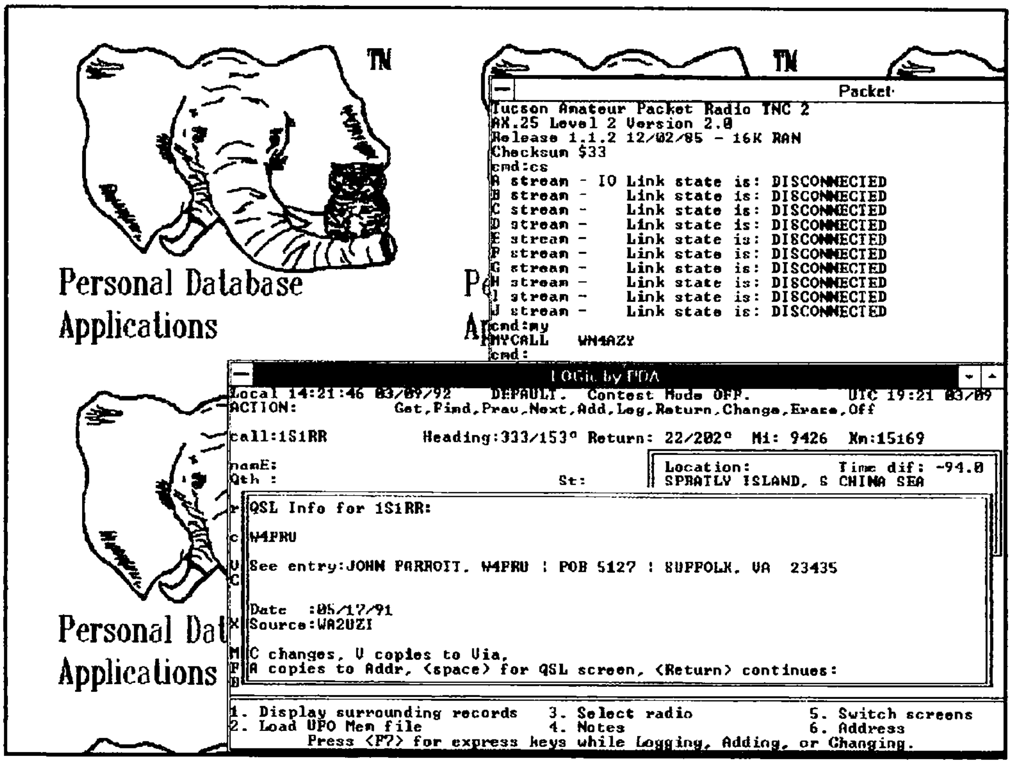


Photo B. LOGic runs under Windows or DesqView. Here LOGic is being run under Windows 3, simultaneously with an external packet program.

tered, a window pops up identifying the location of the station, its continent, time difference, time zone, DXCC prefix, CQ zone, ITU, whether the country is supported by the QSL bureau, and if third party traffic is permitted. On the top of the screen, the short and long path beam headings are displayed, along with the distance to the station. LOGic also informs you if you have worked the station before. If you are using one of the many transceivers with a computer interface, automatic logging of mode, frequency, and band may be accomplished. Complete remote control of the radio is also possible. LOGic will automatically aim your antenna at either the long or short path directions at the touch of a function key if you have a rotor with an RS-232 interface (I did not review the radio interface or antenna aiming function).

While entering data, on-line help is available for each field by pressing the appropriate function key. LOGic also utilizes intelligent edit criteria to minimize errors in data entry. Input of band, mode, state, and several other parameters are checked against internal tables for valid values. All data in these tables may be modified by the user. For example, changing the values of frequencies in the band table for your license class will enable LOGic to warn you if you are operating out of your allocated frequency range.

Screens may be modified for virtually any contest and called up instead of the default screen. LOGic includes screens for almost all major contests already formatted and ready to select via the Select Screen Configuration Menu. LOGic also provides for automatic incrementing of contest serial number, dupe checking, and multiplier tracking. When contest data is entered, it may be merged in with your existing log, or easily removed at the completion of the contest.

Inquiry and locating data in LOGic is simple and fast. LOGic uses indexed files for both date and callsign. No matter how large the database becomes, inquiry by call or date (or partial call or date), is effectively instantaneous. LOGic also will allow inquiry via sequential file search of any field (or any character string within a field). While this is not immediate (and takes longer as the database becomes larger), I found that with a log with 1,800 entries I could search any field within 20–30 seconds. Display of multiple records on one screen is also possible. In this format, it emulates the ARRL logbook configuration.

LOGic's report generation facility is menu-driven and *superb* (it also comes with its own 60-page manual). It contains many pre-configured reports that will probably satisfy most requirements. Tabular reports, envelopes, QSL labels, and several other normal logging formats are provided. These reports may be modified or other reports created from scratch if desired.

LOGic even includes a mail merge capability. This will allow you to generate letters and personalize them with data from your logging database.

If you are presently using another logging program, chances are that LOGic will allow you to import data from it. LOGic comes with programs to import data from K1EA CT (through Version 7), ARIES-1 and 2, HAMRAD, KT5X Contest Logging program, and Swisslog. LOGic will also import data from DBASE III files, standard ASCII fixed-length (SDF) files, or comma-delimited ASCII files. Unless your present logging system uses some really non-standard, proprietary storage format, it should be capable of being imported into LOGic.

Awards Tracking

LOGic really shines when it comes to tracking awards. This system will display your status in virtually any major award in existence. LOGic comes ready to track WAS, DXCC, WAC, WAZ, 10-10 numbers, County Hunting, and Russian Oblasts. Others may be added as you get more familiar with the software. The only thing that you have to be especially careful about when tracking awards is to ensure that your latest QSL information is correctly input.

LOGic derives all other necessary parameters such as ITU zone, CQ zone and DXCC country name from its large prefix tables (greater than 3,800 entries!). For WAS and 5BWAS, LOGic uses the two character state code that you enter during the logging process. This state code is checked in tables to ensure accuracy as you enter it. After I had imported in excess of 1,800 log entries from a DBASE III based logging system, LOGic built all necessary awards tables and indices in a matter of two minutes for a DXCC status report. I did not import the DXCC country name but let LOGic generate that data from its prefix tables. The results were *right on the money*, all stations worked were located in the prefix tables and the report sent to my printer.

The report displays callsign, country name, date and time worked, frequency, mode, QSL status, and signal exchange. Upon completion, a summary is generated showing total stations reported worked and a confirmed/non-confirmed ratio using QSL status data. The report is well formatted and very useful (I didn't realize how far I still was from getting DXCC!).

Final Kudos

While LOGic does not contain a formal packet cluster interface, a small communications terminal program is included that will run in the background with LOGic and allow access to your TNC.

LOGic also has a comprehensive database of QSL managers. This is updated on a periodic basis and is available as an option to the user. LOGic even has a built-in contest keyer for sending CQs and repetitive data during CW contests!

In summary, I found LOGic fast, easy to use, and perhaps most important, reliable. It is a serious logging program for those who want to document more then "Hello and Goodbye" QSOs. The capability to add tailored fields and virtually unlimited remarks allows the user to effectively design his/her own logging system without having to learn a high level computer language. My suggestion is that if you're in the market for a state-of-the-art computer logging system, give LOGic a try. You will not be disappointed.

73 Review *by David Cassidy N1GPH*

Daiwa PS-304 Regulated Power Supply

Electronics Distributors Corp.
325 Mill St.
Vienna VA 22180
Telephone: (703) 938-8105
Price Class: $170

I have never really thought much about acquiring a testbench power supply before. All of my DC power supply needs have been served by standard 12V supplies, with the current rating to match whatever equipment I was running.

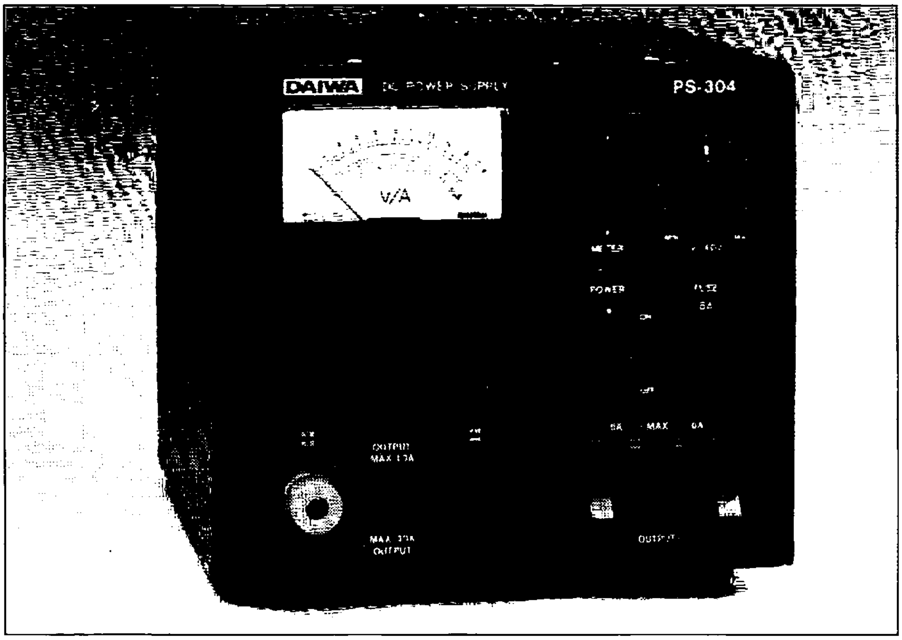
Recently, I've been doing a lot of circuit building. Testing out different circuits is difficult or, if you need other than standard 12V, impossible to do with a power supply designed to just sit there and quietly give you 12V. To aid in my circuit and component testing, I picked up a Daiwa PS-304 regulated DC power supply. I have to admit, now that I have one, I don't know how I survived 20 years of hamming without it.

Up Front

The PS-304 is a rock-solid piece of gear. It provides variable DC voltage from 1V to 15V, and current up to 30 amps intermittent (1 minute on/3 minutes off) and 24 amps continuous (enough to power most HF rigs). A heavy-duty, enameled cabinet and firm, quality switches and connectors give the feel of a professional piece of test equipment. Being a testbench supply, all dials, switches and connectors are on the front panel (unlike your basic 12V supply, where the connections are usually placed on the back).

The face of the PS-304 is dominated by a voltage/amperage meter, switchable between the two by a rocker switch. This allows you to set the voltage to exactly what you need, as well as measure the current draw of a circuit or piece of gear. Voltage is easily set with a rotary knob.

What makes the PS-304 such a convenient power supply to use is the abundance of power connections available. There is a set of screw posts providing up to 30 amps, two sets of spring clips that provide up to 6 amps, and a standard cigarette lighter socket that provides up to 10 amps. This socket also has a tight-fitting cover plate, to keep dust out when not in use. Those who use cigarette lighter plugs to power their mobile gear will especially appreciate this feature.



Documentation

As you might expect, a power supply doesn't require an instruction book to operate it. Even so, the one-page instructions that come with the PS-304 are the hands-down winner for the "Bad Japanese Translation of the Year" award. I actually laughed out loud at some of the twisted syntax and unique sentence construction (not to mention the typographical errors). Since it doesn't take a rocket scientist to operate a power supply, it is easier to be amused in this case than in some others, but the point must be made: When are foreign companies going to start hiring English-speaking writers to supply them with English instructions? Even the most complex instruction manual could be rewritten in about a day, working from someone's bad translation. A single-page instruction sheet would take about 10 minutes to proofread and correct. In this day of desktop publishing and instant printing, this type of carelessness should cease.

Thumbs Up

Most power supplies are set up and then forgotten. You stick them under a desk, or on the back of a shelf, and as long as they don't break down you never give them another thought. The PS-304 is definitely NOT that kind of power supply. If you have varying power needs, or if you do even a modest amount of kit building or home-brewing, you will find this power supply fills your needs beautifully. The quality of construction and ease of use make this a superb addition to any ham's testbench.

DXpedition Lessons from Peter I and Bouvet Islands

Helpful hints for your next exotic radio operation.

by Roald Steen AJ0N/LA6US

Few amateurs have as much experience in arranging DXpeditions to difficult locations as Kaare Pedersen LA2GV and Einar Enderud LA1EE. In January 1987 this two-man team of Norwegian DXpeditioners were the first ones to put 3Y2, Peter I Island, on the air. Two years later, they conducted another memorable DXpedition, this time to 3Y5, Bouvet Island. The Peter I Island expedition of LA1EE and LA2GV resulted in 16,000 contacts with 112 countries; the Bouvet Island expedition of LA1EE, LA2GV, F2CW, HB9AHL and JF1IST resulted in a total of 47,000 contacts with hams on all continents.

I met with Kaare and Einar in November 1990 at Einar's spacious hilltop home in an Oslo suburb, and talked with them about their DXpeditions to Peter I and Bouvet Islands. Their experiences in planning and conducting these two difficult DXpeditions can be a helpful guide to other groups of hams that may be planning DXpeditions to DXCC countries that are hard to get to.

Plan Ahead

Einar had Arctic experience from serving as the manager of a satellite communications facility on the Svalbard Islands, north of Norway, before embarking on the first DXpedition to Peter I Island. His knowledge of Arctic conditions was an important asset during the expedition planning.

Concern for the weather and the seasons must be part of the planning for an expedition to a remote island such as Bouvet or Peter I, Einar explained. Peter I Island is covered with fog during much of the year, so even a helicopter may be unable to land there much of the time. In the far south, you must plan your DXpedition for the northern winter to avoid the severe weather that much of this part of the world experiences during the southern winter.

Most of all, if you would like to arrange a DXpedition to a remote uninhabited island, you will need funds. A DXpedition to an inhabited tropical island in the Caribbean or the Pacific may not cost much more than a regular vacation, but an uninhabited island is likely to lack all infrastructure such as roads, shelters, airport and utilities.

Photo A. Jacky F2CW, Einar LA1EE, Jin JF1IST, Kaare LA2GV and Willy HB9AHL aboard the M/V Aurora.

In common with a few other rare DX countries, Bouvet Island and Peter I Island are both completely uninhabited. Once you are dealing with an uninhabited island when planning a DXpedition, everything becomes much more expensive and complicated. As uninhabited islands, both Bouvet and Peter I are without service by any airline. If you would like to operate from an uninhabited island like 3Y2 and 3Y5, you must arrange your own transportation, and this can be far more expensive than flying to your destination as a passenger on a commercial airline.

Getting There

The Norwegian polar vessel *Aurora* transported Einar and Kaare during their Bouvet and Peter I Island expeditions. The *Aurora* is equipped for polar voyages, and has a crew which is well experienced in navigating in polar regions and in dealing with severe weather conditions.

On an uninhabited island, all of the amenities which you are used to are missing. Since there is no electric power, you must bring your own generator. Fuel for the generator must be brought onto the island, for you will not find a fuel dealership on an uninhabited island.

Bring Plenty of Supplies

And there are other problems. You must bring your own food for the duration of the stay. You may even have to bring your own water or desalination equipment.

Once you finally get there, landing on Bouvet Island or Peter I Island can be a challenge. There are no docks or natural harbors on either of these islands, so landing must be done by helicopter. But, in order to be able to get off the island if the helicopter should malfunction or if visibility should become too low for safe helicopter evacuation, there must also be a way to get off the island by boat or rubber raft in an emergency.

If Kaare and Einar should have been unable to leave Peter I Island by helicopter, they would need to use some mountain climbing techniques. They set up their station on top of a glacier which could only be descended with the help of ropes and mountain climbing gear. Peter I Island has few sites that are suitable

Photo B. The inhabitants of Bouvet Island are elephant seals and penguins.

for access even by helicopter, and the glacier site turned out to be the most convenient site on the island.

For shelter, Kaare and Einar brought tents that were built for use in polar regions. These tents have special insulation between two layers of fabric to keep the cold out.

A Well-Equipped Station

The Bouvet Island expedition was well equipped with radio equipment. In addition to Kaare and Einar, the operator team consisted of Jacky F2CW, Willy HB9AHL and Jin JF1IST. The guest operators also helped in raising funds for the expedition. During the Bouvet Island expedition, the considerable inventory of radio equipment included four triband beams, three Butternut HF-6V verticals and a WØCD Battlecreek Special antenna for 40, 80 and 160 meters, and five transceivers.

Even a portable computer was included to assist in logging. Some interference between the five stations on Bouvet Island was inevitable, since the separation between each station was small. By planning the bands to be used by each station to limit interference, and by using antennas with vertical polarization at some of the stations and horizontal polarization at the remaining ones, interference was kept at tolerable levels.

Licensing

Some rare DX countries are islands that are politically or militarily sensitive, perhaps with a host government which is not too friendly to amateur radio. Fortunately, the Norwegian government is friendly to amateur radio and does not consider these remote islands under its administration to have any strategic value. Reciprocal operating agreements exist between Norway and most countries with a large ham population.

It is even questionable if the Norwegian government could deny anyone permission to land on Peter I Island, since this island is so far south that it is covered by the Antarctic Treaty. The Antarctic Treaty includes guarantees of free access to the continent and the islands that are covered by the treaty to anyone, regardless of nationality.

The Norwegian government has turned Bouvet Island into a natural reservation due to its unique nature and wildlife, mostly composed of elephant seals and penguins. Therefore, it granted Einar and Kaare permission to land on the island provided that they left the island as it was when they arrived there. All garbage and equipment had to be removed when the expedition left Bouvet Island.

Photo C. Erecting a triband yagi on Peter I Island. This was the very first radio operation from this island near the Antarctic continent.

Mutual Benefits

But the DXpedition was asked to leave two artifacts on Bouvet Island. One is an automated weather station, which sends its reports through a French communications satellite system. The weather station, which is not solar powered, has batteries that are designed to last for three years. A plaque of Lars Christensen, a Norwegian ship owner who financed the expedition which claimed Bouvet Island on behalf of Norway in 1927, was also left behind, mounted on a large rock near the camp on Bouvet Island.

An amateur radio operation can provide the island and the host government with a great deal of publicity. And this is the type of publicity which governments like, as ham radio is a peaceful hobby which conveys an image of advanced technology. An event of this type may also be attractive to corporate sponsors that are seeking publicity. Large corporations may be persuaded that they can benefit from sponsoring a DXpedition with its image of advanced technology.

Finding Sponsors

Kaare and Einar utilized these forces during their fund-raising efforts for their two DXpeditions. They received funding from corporate sponsors in a number of countries. They also received contributions from the almost 1,000 amateur radio operators around the world that are members of Club Bouvet.

A television crew followed the expedition to Bouvet Island and took more than seven hours of TV footage. This footage has been edited into television programs that have appeared on European television. Researchers from the World Wide Fund for Nature (WWF) and the Norwegian Polar Research Institute followed the Bouvet Island DXpedition as paying expedition members.

The Peter I Island expedition, on the other hand, was arranged by the Norwegian Polar Research Institute. Kaare and Einar participated in that expedition as paying expedition members to set up their ham radio operation on the island.

If you are planning a DXpedition to a rarely visited location, revenues from television footage may help you balance the books. Kaare and Einar have not put their experiences into a book, being too occupied with their engineering professions in Norway, but a trip like this could also provide good material for a book to earn some additional revenues.

Remote DX Adventures

It may help to be in good physical condition before you start out on a DXpedition to an uninhabited island. And last, but not least, you will need support from other amateur radio operators in the form of fund raising, QSL managers and a support organization, according to Kaare and Einar.

Photo D. Einar LA1EE starting up the generator on Peter I Island.

Photo E. The rugged campsite on Bouvet Island. The M/V Aurora *can be seen in the background.*

73 Review

by Michael Jay Geier KB1UM

The Yaesu FT-26 2 Meter Walkie

Simplicity redefined.

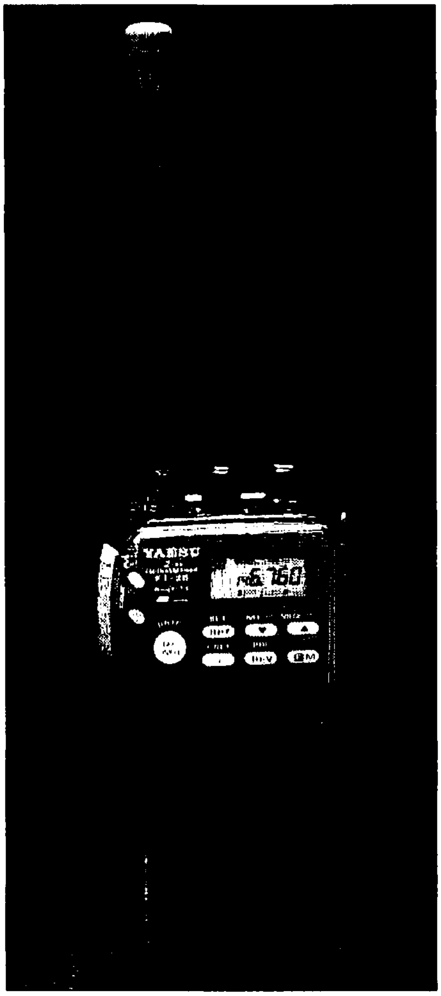
Yaesu USA
17210 Edwards Road
Cerritos CA 90701
(213) 404-2700
Price Class: $330–$350

Yaesu's new FT-26 is the successor to the company's venerable FT-23R series. It's an attractive little walkie that follows today's trend of making the cases thicker while reducing the other dimensions. Its rounded, sculpted shape feels good and fits nicely in my hand.

First Impressions

Although Yaesu's ads show the FT-26 with its standard 7.2-volt battery, the review unit was shipped with the optional 12-volt battery, making it substantially larger than it looks in the magazines. The radio itself is quite small, and the entire package is comparable to other small, modern walkies when the standard battery is used. All the buttons are on the front and left side, making the rig easy to operate. The PTT/Lamp/Monitor switch is rubberized and rounded and has a very nice feel. The speaker produces very good audio for a radio this size. It blows away the audio on my FT-411. The LCD resembles the one on the '411, but the new one is larger and significantly easier to read. Like the '411, this one shows all six digits of the operating frequency, including a real zero at the end. It's great. I wish the other manufacturers would go back to this system. The LCD and the keypad buttons are lit with green LEDs. The lights can be locked on, which is nice for mobile operation at night. Also, they can be set to shut off a few seconds after the last button has been pressed, which is optimum for battery operation. Speaking of those buttons, there aren't many of them! In keeping with the advertised philosophy of simplicity, the radio only has nine buttons on the front and three on the side under the rubber cover. Sorry, there's no DTMF (Touch-Tone) pad.

The top of the rig has the usual volume and squelch controls and antenna connector. Each has a rubber gasket to help seal moisture out. Also present are the mike and earphone jacks, of course, but there's an extra goodie here: a direct 12-volt input jack. You don't have to buy an adapter to slide on the bottom of this rig to use it in your car or as a base station; just plug your cable in and go! Nice touch. To complete the mobile picture, a slide-on cover is provided so that you can remove the battery and still protect the connector on the bottom. In this configuration, the entire radio is about the size of a microphone!



The Yaesu FT-26 2 meter walkie.

But, if you do leave your battery connected, it will charge as you drive. That could be very handy on long trips. The rubber duck antenna is extremely stiff. Its rubber cover is not firmly attached to the BNC connector, and mine started to unscrew when I tried to remove the duck from the rig. This antenna could use some improvement. Finally, the rig comes with a belt clip, but no soft case. The cases are available as options, though.

Lotsa Stuff, Easy to Use

Although the radio is indeed simple to use, it does not skimp on features, save for one important one (more about that later). In fact, there are some new, advanced capabilities. Let's see, you've got 53 memories which can be tuned like individual VFOs. Any memory can hold odd splits or independent TX/RX frequencies. There's one real VFO (the "dial"), and there's a "call" memory which is accessed with just one keypress. The rig also has built-in VOX, which is designed to be used with an optional headset. DTMF squelch and paging are standard. CTCSS is available with the FTS-17A tone board, but it's optional and the review unit did not have it installed, so I couldn't try it out. It appears to function in much the same way as the FT-411's, so it should be very easy to use. RF power output can be selected from four different levels when using 12 volts, for a maximum of 5 watts out. At 7.2 volts, three levels are available, with 2 watts being the highest. During transmit, the LCD depicts the power output by showing appropriate numbers of steps at the bottom (where the S-meter is during receive). Note that this is not an actual measurement of power output—it is just a display generated by the microprocessor. On most walkies (which have only HIGH and LOW power settings) this is silly, but it has a purpose here, because it reminds you of which of the four steps you have chosen.

The Automatic Battery Saver (ABS) has a new twist. It monitors your operating history and adjusts itself to the optimum saving ratio without your ever knowing about it! If you don't like that, you can set it manually for three different ratios, or you can turn it off for packet operation.

The Automatic Power Off (APO) function lets you select from 10, 20 or 30 minutes and, of course, permits you to disable it. To save even more power, the BUSY LED, which lights to indicate that the squelch is open or the channel is busy, can be turned off, as can the musical keypad beeper.

The Automatic Repeater Shift (ARS), which sets the offset for you in accordance with the band plan, can be adjusted to various repeater subbands, as well as turned on and off. I surmise that this is used primarily for setting the radio to the subbands of different countries. I can't imagine why you'd want to change it here in the U.S.

For true beginners, the radio can be turned

into a channelized, CB-like unit by selecting the "memory only" mode. In this configuration, only channel numbers, which correspond to memory numbers, are displayed. No frequencies, nothing! Also, most of the rig's features are locked out. This might be useful for a true technophobe's first week of ownership but, beyond that, I don't see the point, especially since you must program the frequencies in first to use it! Perhaps it could be helpful for someone who is physically or visually impaired.

Basics

The radio receives from 130 to 174 MHz and transmits from 140 to 150 MHz. Receive sensitivity is excellent and holds up very well outside the ham bands. Selectivity is as usual for Yaesus. In other words, superb. When you are 5 kHz off, you *know* it.

As I mentioned before, receive audio is very good. The speaker has better bass response than most small rigs, which makes it sound much nicer, especially on male voices. It is reasonably loud for its size but, as you might expect, it can be hard to hear in a noisy car or truck. Of course, you can hold the whole rig up to your ear because it is so small. Also, there are optional speaker/mikes, and even a new earpiece/mike which has a separate mike you clip to your shirt.

The radio has all the usual scanning and priority functions, and it lets you shield memories from the scan while still allowing you to hear them manually. You also may hide them altogether. The scan speed is about the fastest I've ever seen; it really zips through the band.

FT-26 Specifications

General	Frequency Range (MHz)	RX: 130–174 MHz TX: 140–150 MHz	
	Channel Steps	5, 10, 12.5, 15, 20 & 25 kHz	
	Standard Repeater Shift (Resettable)	600 kHz	
	Emission Type	G3E	
	Supply Voltage	5.5–16 VDC	
	Current Consumption	Stand-by (with 1-sec. save)	19 mA
		Receive	190 mA
		Transmit (5W)	1.5A
		Auto Power Off	6 mA
	Antenna (BNC Jack)	YHA-17 Rubber Flex Antenna	
	Case Size (w/FNB-25)	2.2 x 4.6 x 1.3 in. (55 x 116 x 33 mm.)	
	Weight (approx., w/FNB-25)	0.8 lbs.; 360 g.	
Receiver	Circuit Type	Double-conversion superheterodyne	
	Sensitivity (12 dB SINAD)	Better than 0.158 μV	
	Adjacent Channel Selectivity	Better than 60 dB	
	Intermodulation	Better than 65 dB	
	Audio Output (@ 12V)	0.5W @ 8 ohms for 5% THD	
Transmitter	Power Output	5W w/FNB-27; 2W w/FNB-25	
	Frequency Stability	Better than ±10 ppm.	
	Modulation System	Variable Reactance	
	Maximum Deviation	±5 kHz	
	FM Noise	Better than −40 dB @ 1 kHz	
	Spurious Emissions	Better than 60 dB below carrier	
	Audio Distortion @ 1kHz, w/3 kHz deviation	Less than 5%	
	Microphone Type	2-kilohm condenser	

Using It

Because there are so few buttons, some of the more advanced operations require some arcane keypress sequences. Luckily, there aren't too many of them, and none is anything you will use very often. For everyday operation, the radio couldn't be easier to use. While you cannot enter frequencies directly (because there's no number pad), the rotary dial, in conjunction with the MHz step function, lets you get where you're going without too much trouble. Most operation is from the memories anyway. Other than that, there's not much to tell. This is a basic, solid walkie.

What's Up, Docs

In many of my reviews, I've complained bitterly about the incomprehensible documentation. This time, though, there's nothing to complain about. The booklet is first rate. It is written in *English* and, except for a few insignificant typos, is about as close to perfect as I could hope for. Even the section on DTMF squelch and paging is easy to understand. See, it *can* be done. Also included are full schematics and a handy, wallet-sized cheat sheet. Nice job, folks.

Oops...

The DTMF squelch and paging modes require both the sending and receiving of tones, so the rig obviously has a tone-generating chip inside. Despite this, *you cannot make autopatch calls from this radio*. Nor can you use it to control special functions on a repeater. It can only send 3-digit codes, and only zero through nine. It cannot send the star or pound sign. All the new rigs (at least the ones I've seen) which have DTMF paging use the same three-digit, 0–9 scheme. Like the others', the FT-26's inability to send the star and pound sign makes the selective calling features unusable through most modern repeater controllers, which will not pass the tones without prefixes containing the special characters. Of course, it works fine for simplex use and is especially handy at hamfests.

Conclusion

I like this radio. It works well and keeps the "bells and whistles" to a minimum, or at least unobtrusive. If you need the paging or you are turned off by lots of programming options (and can live without autopatch), the FT-26 is for you. If, however, you need the CTCSS or autopatch, check out Yaesu's gorgeous new FT-415, which I'll be reviewing very soon. Either way, Yaesu's got a walkie you're sure to love.

Say You Saw It in *73*!

Number 15 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
PO Box 2508
Fullerton CA 92633

School Days and Dual-Band J's

Whether you are a new ham or an old-timer, a techie or an appliance op, radio direction finding (RDF) contests can add to your ham radio fun. More and more clubs are adding these events, often called hidden transmitter hunts, foxhunts, or T-hunts, to their monthly calendar of events.

Everyone says that we need more young people in amateur radio. So why isn't everyone making better use of an unbeatable tool (foxhunting) for getting kids interested in our hobby?

At the annual Science Extravaganza, a hobby show put on by the Youth Science Center (YSC) of Orange County, California, we always have RDF demonstrations in addition to the usual HF/VHF/ATV/OSCAR/packet displays. Nothing else gets youngsters excited about radio more than "sniffing out" one of the two hidden T's on the grounds, using the RDF gear we provide.

I'm not a schoolteacher, so I don't get to do this sort of thing regularly. To my dismay, I am finding that far too many non-ham educators are fearful of science and ignorant of ham radio. (YSC is trying to change that!)

All the ham operators who teach in my school district can come up with a dozen reasons why they can't use amateur radio in their classrooms. So I am thrilled to read of educators like WB2JKJ and WB2MGP who are using it in spite of the obstacles. But it can be even better when T-hunting is part of the ham radio curriculum.

Sooner Scholars

Don Loving N5NDE is a science teacher in Burneyville, Oklahoma. Turner High School, which has about 100 students total, is in a rural area near the Texas border. Don has made amateur radio an important part of his physical science class. A dozen teens are now proud owners of ham tickets (see Photo A).

"My kids are more enthusiastic about transmitter hunting than any other radio activity," Don told me. "Ordinary on-air QSO contesting bores them to tears. They like it at first, but they get burned out pretty quickly. Teenagers need something more active, like foxhunting."

The Turner High RDF program is still young, but holds lots of promise. "Right now we're short on equipment," N5NDE reports. "I have a couple of kids assigned to building a Doppler set, and we have obtained the money for parts.

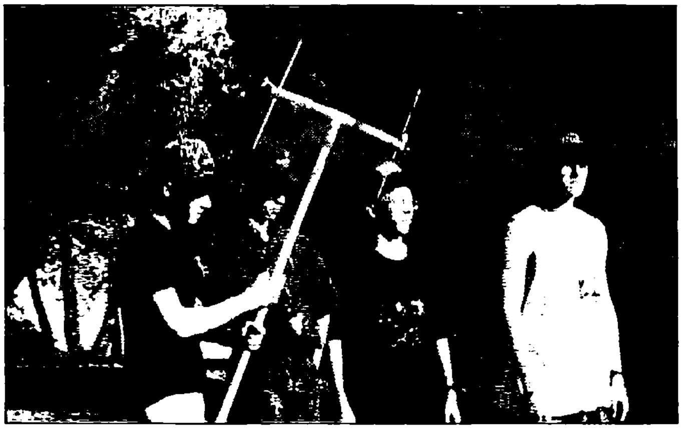


Photo A. Turner High School students built a "shrunken quad" to find elusive hidden transmitters. Left to right, they are Andy Barthel KB5ONC, Gregg (no call yet), Rodney Blankenship KB5ONB, and Wes Hearell N5OFA. (Photo by N5NDE.)

"My kids prefer to be the fox. The adults and anybody else who wants to come out can try to find us. We have already had one walking hunt and one driving hunt."

Support from the ham community would be a big help to a program like this. "We tried to have a couple of contests at the local hamfests," Don says. "At the one at Oklahoma City, we only had a few people show up, one from Texas. We had a good time but we only had three or four people that hunted.

"We don't have any ham clubs close by. There is a repeater within range, and we talk it up on that. Mostly we have to go to hamfests that are a couple of hours away."

Don's plans for the future include using RDF for search and rescue (SAR). He would like to run an SAR Explorer post. "We had a small four-passenger plane crash a few years ago that affected the whole community," he says. "Hams were out searching for the plane. That brought up the idea of SAR in these kids' minds, because they all lost some friends."

We need more hams like Don Loving in education. How about setting up a foxhunting program for your school system? Lack of RDF experience is no excuse—N5NDE didn't have any when he started, either. Here is an opportunity for the teacher to learn along with the students.

You're Never Too Old

Don't get the idea that RDF contesting is just for kids. The dozen T-hunts every month in Southern California bring out fun lovers of all ages. One perennial participant is Milt Ronney WA6FAT (see Photo B). Milt celebrates his 80th birthday this year. He started T-hunting in the 1950s and has never grown tired of it.

In his 35 years of 2 meter DFing, Milt has followed technology, going from an AM "Gooney Bird" to the newest imported rigs. He was part of the hiding team that set the record for longest distance 2 meter hunt (252 air miles). He is also a regular on the monthly 6 meter hunt.

Put a hidden transmitter on the air and chances are Milt will come out to find it. That is, he will if he is not enjoying his other hobby—square dancing with his wife Elizabeth.

A Black Box That Talks

Clever "foxes" like to conceal their transmitter/antenna setups in out-of-the-way nooks and crannies, then talk through them remotely. One easy way is to use a dual-band VHF/UHF transceiver that has been modified for crossband repeat operation. (Information on such modifications is often provided by manufacturers and dealers.)

A typical example is the 2 meter hunt that WA6OPS and I put on for the Orange County (California) RACES group last November. It was intended to be a relatively easy nighttime training exercise, but we wanted to give the contestants something unexpected. Most of them were new to the RDF scene.

I put my IC-32AT 2 meter/70 cm handheld and a 20 amp-hour 12 volt battery in a box, painted black. We concealed this lashup in a bush, a few feet off a dead-end road in Anaheim Hills. We parked our van a couple of blocks away in a good spot to view the bush, but where we could not be seen from the dead end.

Hunt time came, and we began our regular voice transmissions on 446 MHz, repeated onto the 146 MHz hunt frequency by the concealed dual-bander. It took the first team about an hour to DF up to the road end. Not seeing anyone talking into a microphone, they drove off and were not seen again for another hour. Team after team did the same thing, or else sat there, peering at the dead end, expecting to see us crouching in the bushes.

After lots of encouragement from us, most of them got out their flashlights and beat the bushes to find the black box. These fledgling hunters won't soon forget the lesson they learned: Follow your RDF gear and expect the unexpected.

"Homing In" readers around the country have told me of the fun they've had using dual-banders as remotely operated foxes. Mobile dual-banders usually have separate antenna connectors for each band, but the single antenna jack on dual-band HTs can pose a problem. You need an antenna that is better than a "rubber ducky" so the hunters can hear you at the start point, but it has to be effective and a good match on two bands.

For the RACES hunt, I used a 2 meter J antenna. Theory predicted it would work great, and it did. The half-wavelength radiator of a 2 meter J is 3/2-wavelengths on the 70 cm band. It does not have gain toward the horizon, but it works just fine for linking to the control point. The quarter-wavelength matching section at the bottom is 3/4-wavelength at 446 MHz, so it has the same transformer characteristics. (Such matching sections may be any odd multiple of a 1/4-wavelength.)

I have used this J design on 2 meters for several years. The J is an excellent antenna for public service and emergency work because it does not require a ground plane. I mounted it on a 1/2" thick plastic base, 8" x 8". Wood works fine for the base, too. You can set it just about anywhere (preferably high and in the clear), hook up the coax, and be on the air in seconds.

Figure 1 shows the dimensions. The elements are 1/8" diameter stainless

Photo B. When Milt Ronney WA6FAT hides the T, you never know what to expect. This time, he is testing the "river effect" on VHF propagation by setting up in the middle of Santiago Creek.

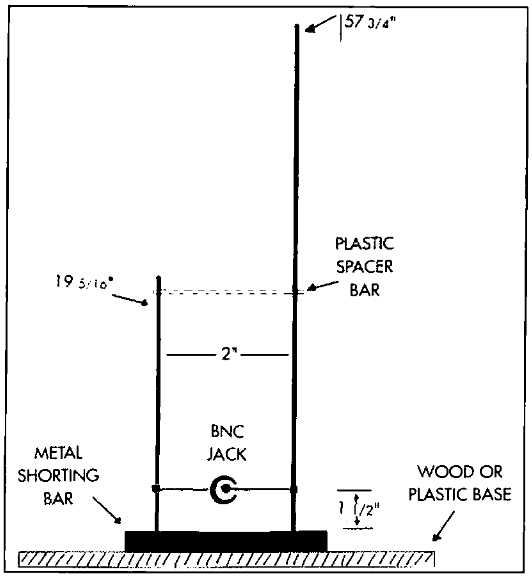


Figure 1. This easy-to-build 2 meter J antenna also works on 70 centimeters. See the text for element information.

steel welding rods. Stainless elements are strong, flexible, and non-corrosive, but attaching them at the bottom is a problem. You may prefer to use brass or bronze rod if you are not equipped to solder stainless steel or to drill/-tap the shorting bar to accept the rods.

The shorting bar at the bottom is mandatory, but do not connect the bar to the rig's ground. For this hunt, I covered the elements with black electrical tape to make the antenna invisible in the bushes under the street lamps.

Center the coax connector between the elements. I prefer a BNC receptacle instead of the usual SO-239. Clamp the wire leads from the connector to the elements at the points shown. You may need to slide the connector assembly up or down to achieve the best SWR, but both leads should end up at the same distance from the bottom shorting bar.

The plastic spacer is important to keep the matching section elements parallel, two inches apart, at all times. I held my spacer in place with hot glue, but you could drill and tap the plastic for setscrews.

My handheld is happy with 2:1 SWR, which was easy to achieve on both bands. With a little pruning and tweaking, you should be able to get 1.5:1 or better at your hunt frequency.

A Store-Bought Alternative

If you would rather buy a J than build one, consider the new Pocket Roll-Up J from MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323-5869. The MFJ-1730 (see Photo C) uses TV-type twin-lead for the matching section and radiator. It features a ferrite choke balun to keep RF off the coax shield and improve the match. A 4-1/2′ RG-58 pigtail with BNC connector goes to your handheld.

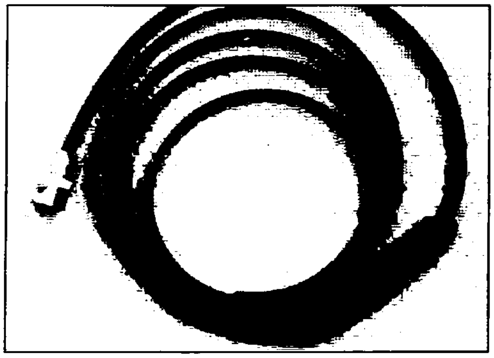


Photo C. The MFJ-1730 Pocket Roll-Up 2 meter J antenna is easy to carry to the hiding site. The bulge is the ferrite choke balun.

While it won't stand alone on a table like the antenna of Figure 1, the Pocket Roll-Up is much easier to transport. It is ideal for hanging from a tree or bush. It will support its own weight, but I would not recommend using it to hold up the rig, particularly if you use an oversize battery. The internal solder connections may not withstand that much strain. Support the transceiver underneath, use the belt clip, or suspend the rig with a separate piece of nylon line.

In my tests, the J of Figure 1 and the Pocket Roll-Up gave equal performance on both 2 meters and 70 centimeters. Range was much greater than a quarter-wave whip in each case. My wattmeter measured 1.3:1 SWR on the MFJ-1730 at the 146.565 MHz Southern California T-hunt frequency, rising to 1.8:1 at 148 MHz and 2.4:1 at 144 MHz. Lowest SWR on 70 centimeters was 1.2:1 at the high end of the band, rising to 2.3:1 at 440 MHz.

Even on an intermittent-signal T-hunt, the transmit duty cycle is higher than in a casual QSO. So give your HT some extra cooling help. I removed the belt clip and bolted a 3″ finned heatsink in its place for the RACES hunt. That was sufficient for a 5 watt HT on a cool evening, but you may need a small 12 volt fan on a hot day. Happy hiding!

Ham Television

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Wisconsin ATV Flight

On December 7, 1991, a group from Hillsboro, Wisconsin, launched an ATV balloon with some interesting innovations. I think you'll find some of these ideas of value for your ham shack or repeater installation.

The Package

Based on the successful flight and recovery of their previous voice repeater flight, Joe Mayenschein WB9SBD and Tim Tomljanovich K9SB decided to risk a full video package on this mission. The ATV section consisted of a PC Electronics KPA5-RC 1-watt ATV transmitter (439.25 MHz) with an FMA5 audio subcarrier board, a miniature B/W TV camera (similar to the one offered by both GBC Corporation and Micro Video Products), a Uniden Bearcat 100XLT scanner and a 10 meter AM transmitter on 28.322 MHz (see the April '92 issue of *Radio Fun*, p. 18) with voice ID (see the November '91 issue of *73*, p. 11). The antenna system consisted of an Olde Antenna Labs Mini-Wheel for ATV, a dipole for 10 meters and a ¼-wave whip for VHF.

In addition to the live ATV camera transmissions, they programmed the scanner to receive on two channels on 2m FM. One frequency was the "free-for-all" uplink and the other was a priority channel for control of the mirror system and to make announcements from mission control.

Anything heard on the 2m uplink was repeated down via the ATV audio subcarrier as well as the 10 meter AM transmitter. In essence, this would be a super-wide coverage crossband repeater!

Remote Camera Pointing

Joe WB9SBD came up with a very inexpensive and effective method of remote camera pointing. Rather than move the entire camera around with servos, Joe mounted a motor-driven first-surface mirror in front of the TV camera at a 45° angle. The first surface mirror (cat. #2741) is available from American Science Center; (708) 475-8440. Edmund Scientific is another good source of first surface mirrors.

With two angled pieces of PC board material, Joe was able to suspend the motor/mirror assembly at just the right point above the camera. Viewed on edge, the two pieces of PC board in the field of view of the camera are hardly noticeable (see Figure 2).

The motor-driven mirror rotated at 0.5 rpm, giving them a continuous 360° pan of the camera view every 2 minutes. The motor (12 VDC at 0.5 rpm) is made by Hankscraft and only draws 4 milliamps when operating. You can contact Hankscraft at (608) 524-4343; a variety of operating voltages and rotation speeds are available. If you plan to send one up in a balloon, be sure to specify a greaseless motor to handle the −60° temperatures in the upper altitudes.

Joe and Tim added a Norcon touch-tone controller (model TD16 with 16A expansion module) which allowed them to turn the motor on or off by remote control. To change the camera view, they just activated the motor via a touch-tone sequence and waited for the mirror to rotate to the desired point. Keep in mind, however, that the image as viewed through the mirror will be reversed. Some TV cameras have a reverse scan switch which allows you to compensate for this effect.

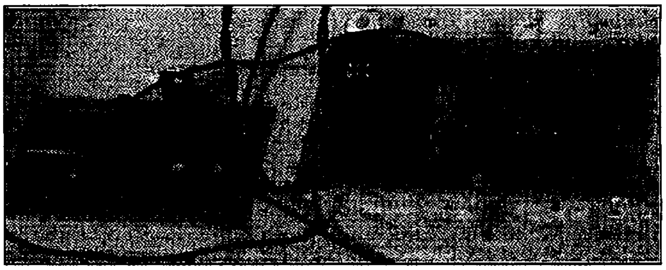

Photo B. Inside view of the payload showing the 10 meter AM transmitter and voice ID circuitry.

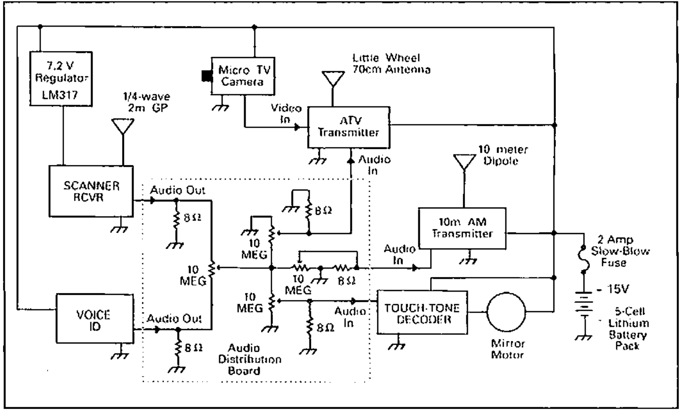

Figure 1. Schematic diagram of the balloon payload.

To identify their balloon ATV transmission, they mounted a thin strip alongside the edge of the package with their reverse image callsigns. Since the camera focuses from 6" to infinity, this method of video ID worked very well during the flight.

The Flight

After a late night session of final construction and testing, the launch team assembled near Joe WB9SBD's farm around 7:30 a.m.. After various Murphyisms (the N-connector on the receive antenna fell off, the regulator on the helium tank wouldn't fit and there was intermittent video from the payload), everything somehow came together.

At 9:45 a.m., the HBT-2 (Hillsboro Balloon Team) mission took off under near ideal ground conditions. Since a storm front had cleared out of the area a few hours earlier, visibility was excellent. Everyone watching the ATV downlink at the launch site was treated to spectacular views of the rolling Wisconsin farmland. The remote mirror system worked great. The touch-tone system worked perfectly, allowing the control station to easily point the camera view at the horizon, at the ground below or even up at the balloon itself.

Reports came rolling in via the HF net on 7.155 MHz (Scott ND9C was the net control). Just 10 minutes after takeoff, Mike WB0QCD reported seeing P4 pictures from Iowa. Soon afterwards, reports of nearly snow-free video reception came in from Ron W9ZIH in northern Illinois and Andy N9AB and others in the Chicago area. One station even reported seeing P2 level pictures in Arkansas! Apparently there was some interesting ducting going on during the flight.

Both the ATV audio subcarrier and the 10 meter AM downlinks from the crossband voice repeater system worked quite well. It was fascinating to hear distant stations describing their video reception on the 2 meter talk frequency.

Treed

Although the ground wind conditions were great, the upper level winds were another story. Since the jet stream winds were over 100 knots, it was decided to use a much smaller balloon to shorten the total distance traveled. This resulted in a short flight that made it just to 45,000 feet before the balloon burst. However, since the small bal-

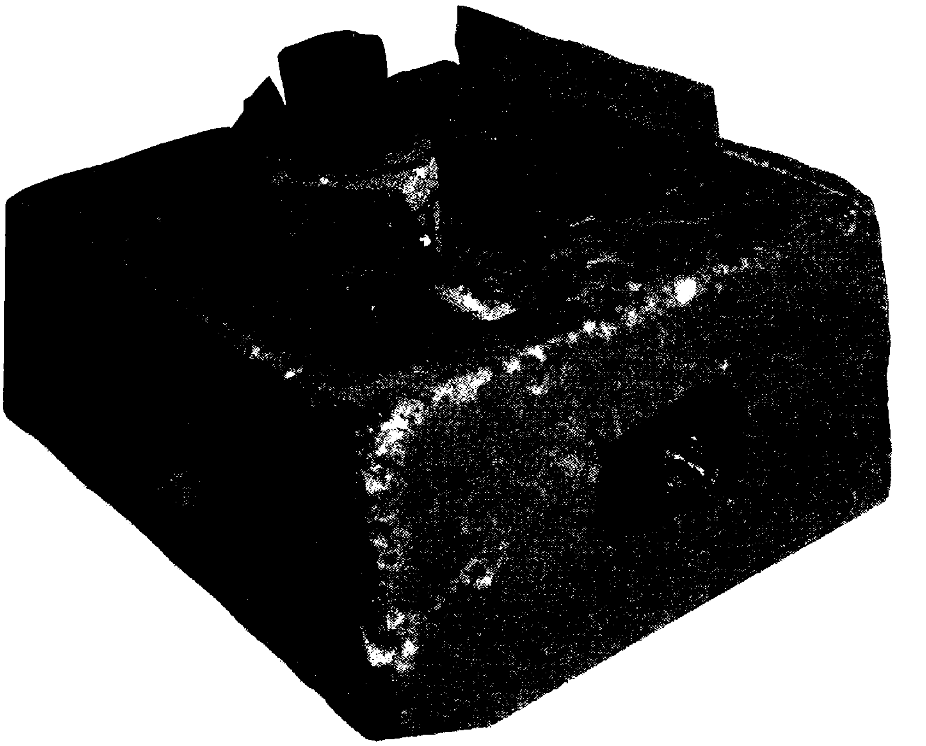

Photo A. The completed payload showing the unique rotating mirror system. The motor turned a mirror (slanted 45°) in front of the TV camera which provided a continuous 360° view every two minutes. The callsigns are reversed so they appear normal in the downlinked video as seen through the mirror.

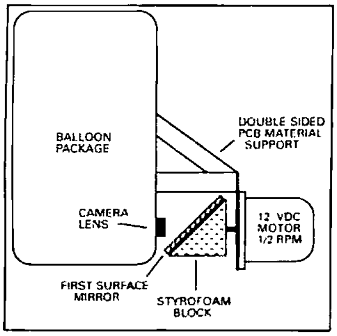

Figure 2. Details of the mirror mount.

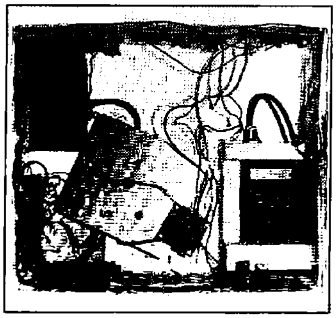

Photo C. Inside view of the styrofoam package showing the Uniden Bearcat scanner (upper left), ATV transmitter (center, in shielded case), back of TV camera (lower right), voltage regulator (upper right), touch-tone decoder (lower right), lithium batteries (lower left) and the 10 meter AM transmitter (upper left).

loon covered more than 60 miles in the 45 minute ascent (average ground speed of 80 mph), the large balloon capable of reaching 100,000 feet in altitude would've dropped the payload some 160 miles downrange (right in the middle of Lake Michigan!).

Since the balloon burst somewhat sooner than expected, most members of the chase team were too far downrange. Through triangulation of beam headings and by watching for landmarks on the video signal (a large lake helped), the location of the landing site was narrowed down to an area just 10 miles east of Portage, Wisconsin. It was found 15 minutes after touchdown, dangling 40 feet up in a tree near the town of Rio (on the property of the Chief of Police). One brave soul scaled the dry, frozen, and relatively branchless tree and safely brought the package (and himself) back to the ground in perfect shape.

Joe WB9SBD, Tim K9SB and the Hillsboro group plan a number of future flights with a variety of intriguing payloads. If you'd like to find out about amateur radio balloon payloads, Joe has started a BCAR (Balloon Carrying Amateur Radio) net on 14.255 MHz every Saturday afternoon at 3 p.m. Central time. Also check out the "Balloon" area on the *73* phone-line BBS for the latest information. 73

Photo D. (l to r): Tim K9SB, Stuart WB9UNX, chase dogs (Blackie and Teddy), Joe WB9SBD and Brian KA9QJT prepare to launch the balloon.

Photo E. The recovery team after retrieving their prize from the tree. (l to r): James N9LKY, Jim N9KAN (behind James), Steve WB9ZRE, David KE9KX, Lennart KB9GDY, Brent Hughes and Tim K9SB.

Number 17 on your Feedback card

HAMS WITH CLASS

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Miami Tropical Hamboree

Attending the Tropical Hamboree in Miami has always been a terrific experience for me. This February, however, those hams and non-hams alike who came to assess the role of youngsters in the hobby were in for a real treat. Under the extremely capable guidance of Evelyn Gauzens W4WYR, who is the General Chairperson of the event sponsored by the Dade Radio Club, Inc., hundreds of free passes were distributed to local schools for children to be able to attend at no cost. The tremendous efforts and hard work of Evelyn and the club really paid off. Not only was the Hamboree a huge success, but the Youth Forum which I had the privilege of moderating was well attended by children. Many parents came to the forum, too, but more importantly, the young people showed up to hear what their own peers had to say about amateur radio.

As a teacher who deals with hundreds of children a year in my own school, I certainly appreciate and applaud the efforts of the manufacturers to encourage youngsters to get involved with amateur radio. We should all support the manufacturers who support the educational forums and programs across the country. The main prize to be awarded to a young person in attendance was a Kenwood R2000 wideband receiver. I wish everyone could have seen the look on the face of the little boy who won it. It was wonderful! ICOM, Yaesu, and the ARRL also contributed door prizes, much to the children's delight. The dedicated folks at MFJ and Heath have always been very supportive of my educational efforts with amateur radio. Special thanks must go to Rosalie White WA1STO, educational coordinator of the ARRL, who was a big help with the publicity and gathering of prizes for the Youth Forum. Rosalie also moderated the Instructor's Workshop that weekend.

The Youth Forum

Well, I certainly had an outstanding group of children to work with in Miami. What a joy to have articulate, enthusiastic young people volunteer to speak to a packed room of children and adults about their love of amateur radio. These youngsters are the future leaders of our hobby, and I'm so delighted to have been able to showcase them at the Hamboree.

> *"What a joy to have articulate, enthusiastic young people volunteer to speak to a packed room of children and adults about their love of amateur radio."*

Chris Hadden NØGXB was the first to speak. Chris is the 1991 recipient of the ARRL Paul and Helen Grauer $500 Scholarship. Chris is a computer science major at the University of Nebraska. He is actively involved in many different modes of radio communications and provided an excellent role model for the youngsters in attendance.

Next at the microphone was the very eloquent Lee Cicreszko N4TCW, 18 years old. Lee made quite an appearance dressed in his Police Explorers uniform. He was busy the whole weekend helping out with communications at the Hamboree. Lee explained his love of public service, working with the Sheriff's office and helping out at local public activities. He also was very adept at answering questions from our young audience about UHF, VHF and radio wave propagation. I'm sure that Lee's involvement in amateur radio was largely responsible for the self confidence and ease that we in the audience could easily see he possessed.

MY next speaker is no stranger to making public appearances. Sammy Garrett AAØCR, age 14, is the winner of the Westlink 1991 Young Ham of The Year award. I've had the pleasure of working with Sammy before. He was a guest speaker at my Youth Forum in Dayton in 1991 and did a terrific job there also. In his talk, Sammy stressed that you don't have to be a nerd or a great brain to get involved with the hobby. He said that any kid who really wants to get into ham radio and have fun with it has a good chance to do it. He also cautioned the young people to not let it consume their lives to the exclusion of other important young people's activities.

Mike Abbattista KD4CQT is 13 years old and in the 8th grade. He is a student of Phyllisan West KA4FZI, who has a wonderful ham radio program that encourages less advantaged children to get involved with technical studies at Caloosa Middle School in Cape Coral, Florida. Mike showed us a simple, easily assembled telegraph key made by youngsters in his class. Mike is also an active member of the Ft. Myers Radio Relay League.

Everyone at the forum was totally captivated by Louis Zuckerman KD4HRD, who is a bright, vociferous 8-year-old. Louis got his license in December 1991, much to the delight of his fellow 3rd graders. Both mom and dad are very active in the Dade Radio Club of Miami. After meeting with this enthusiastic ham family in Miami, it was obvious to me that Louis is going to have many fabulous, fun years ahead of him in ham radio with his folks. Louis told the group assembled that he especially loves talking to radio operators in foreign countries. He's already had a terrific QSO with someone in Japan named Hida JF1SEK on the day of President Bush's visit there. What an inspiration this youngster can be for other children!

Torben Bush KC4ZNI is 16 years old and attending Coral Gables High School. He told us how he attended the evening amateur radio class taught by Harry Pilafian W4SQG, along with his dad. Torben helped form the Dade Young Amateurs Association. This group was formed so that youngsters could have their own organization under the supervision of adults. He is also a member of the South Florida FM Association and the ARRL.

Derek Urwin KD4DIF is presently in the 7th grade at Arvida Middle School and has his General license. Derek was in Audrey Pilafian KB4ZQU's gifted 6th grade class last year. He got interested in ham radio when Harry Pilafian taught several classes there. Both he and his father attended Harry's licensing classes in the evening. He too is a member of the South Florida FM Association and the Dade Young Amateurs Association. Let's never underestimate the influence that a teacher can have by exposing youngsters to interesting, stimulating, and exciting demonstrations.

Paul Kunicki KC4YWK is 14 years old and has a Technician license. Paul spoke eloquently about his move from CB to ham radio. His father is a ham radio operator also. He is an active member of the Dade Radio Club of Miami and maintains the club station, W4NVU.

Every one of these young presenters made a profound case for the advantage to all of us in recruiting bright, motivated boys and girls into ham radio. Please be on the lookout for articulate and enthusiastic youngsters who would like to join me in participating in other youth forums. Have them get in touch with me; it's a marvelous experience for a young person. ■

Never Say Die

Continued from page 4

board displays in New Hampshire hotels and motels selling film and offering processing.

Everyone visiting New Hampshire brings a camera or two, so why not put the film right out there where it's easy to buy and give the motel a commission on the sale? And get them to get their guests to send in the exposed rolls for processing for another commission. The finished pictures can be mailed to their home address. He'd soon have a fairly large business going and be able to expand into Vermont and Maine, both good vacation states.

I don't know if he has the drive to try and start a business, but there's one just waiting for someone to make it happen. That could build into a multi-million-dollar business in two or three years.

There are unlimited new business possibilities if people would only start thinking in those terms.

We have many products which could be developed for foreign sales. I don't know if you're aware of it or not, but America is one of the largest exporters in the world. Our exports have been growing recently and are now within $17 billion of our imports. Quite a turnaround.

The recent growth of new licenses as a result of the no-code Tech license has gotten a rash of new small businesses going in the ham market. Our new ham population has doubled in the last year...which is why *Radio Fun* has been doing so well. It reaches these newcomers and gives them the information they enjoy reading. I'm delighted at some of the testimonials I've been seeing from advertisers too. The ham market is beginning to show some life. Too bad if you're not getting *Radio Fun*!

More Unreasonableness

You've been reading about the mess our American educational system is in and the desperate need for restructuring. You've read about how our students are among the worst in the developed world in math, science, geography and so on. Of course we make up for this incredible lack of results by spending more than double what most countries do per student.

One result of this disaster is that we have such a poorly educated work force that we're no longer competitive with other countries with better education systems.

Yes, I know I should be busy working DX on 20m and shouting curses at KV4FZ, but I can't seem to help myself from getting embroiled in this education mess. You see, I have this fanatic religious conviction that amateur radio is a key to helping fix this whole thing. I know my vision is not shared by many hams and is abhorred by the ARRL. The last thing the old-timers running the League want is a zillion kids lousing up their bands.

So my quest to get an eight-year course in the fundamentals of electronics, communications and computers into every school in America, backed up with radio, computer, science fair, and electronic experimenter clubs, is just another of my windmill jousts... like my campaign for the no-code license.

My vision is of two million American hams...no, make that three million...shouldn't we at least have double the number of hams in Japan, where they have half our population? And I see our newcomers going back to 80% youngsters as it was in the 1950s. Further, I see amateur radio again becoming visible to the general public and performing a service worthy of the frequencies we have allocated. I see our main service to America as a supplier of enthusiastic high-tech career youngsters who will help build tens of thousands of small high-tech companies.

Poor old dreamy Wayne...the clean air up there in New Hampshire must have gone to his head. Maybe. But it hasn't stopped me from getting involved with the New Hampshire Economic Development Commission Education Subcommittee and with the New Hampshire High Tech Council Education Subcommittee. Nor has it stopped me from reading everything I can find about restructuring our educational system or attending workshops on the subject.

The result is that I have a fair idea of what's gone wrong and, as usual, some creative ideas on how to improve things. If you're interested in my reports to the governor, the Economic Development Commission, and so forth, you can get a dump of my writings via the *73* BBS. Or you can send $2 to cover duplication and mailing to Professor Green, 70 Route 202 North, Peterborough NH 03458.

For that matter, I'm working on a book form of my complete report to the Commission. I hope to have it available in May. $20 should cover the cost... hey, it's going to run close to 300 pages. That sounds like a lot of money, but a ham in Alaska got a copy from our BBS and has already started some of the creative new businesses I outline in the report.

Reinventing Schools

How radical are my educational ideas? In addition to the tech course and high-tech clubs, I'm recommending that schools go to 50 weeks a year with 10 five-week terms. That leaves a week off at Christmas and another in July.

It gets worse. I'm also recommending that we end compulsory education in New Hampshire...that we allow students to progress at their own speed instead of in factory lock step...that students be allowed to take five week vacations when they want, taking off for a term now and then. No grades. No exams. Students work in teams of four instead of singly. The pass-fail decisions will be made by one's fellow students, not the teacher. No more "teachers" either; now they'll be facilitators and team leaders.

Well, you'll have to read my papers on the subject to understand the reasoning behind all this and how it all fits together as a completely new educational system. Much of the responsibility for one's education will rest on the students and their parents. I've also suggested ways of getting parents far more involved with the whole process.

Isn't that what freedom is all about? Why should all children be sentenced to 10 years of involuntary servitude in government institutions? We call that slavery when it's adults. Isn't it time we slowed down on doing things for people's own good and started using reason and rewards to encourage compliance?

At 70 I don't know if I'll live long enough to see either the rebirth of amateur radio or its death...but I know one or the other can't be far ahead, with no middle ground visible. You can check back over 42 years of my editorials to see how accurate my visions are. After reading a few old issues of *73* do you really want to bet I'm wrong? How much?

I suppose I should do like 90% of our retired hams and devote the rest of my life to rag-chewing and golf instead of getting all het up about education and helping New Hampshire out of the recession with a long list of proposed strategic initiatives.

None of my initiatives are really peculiar to New Hampshire. Many would help other states to cut down on state expenses, cut taxes, help industry to grow, and re-invent education. I don't want to suggest for a minute that you cut down on your rag-chewing, golfing or watching football on TV. I know that 99.9% of you won't have the drive to try to actually *do* anything, but I kind of hoped a few of you might at least be interested enough to read what I've written and write to tell me that you don't agree with everything I propose...naturally omitting any details on what you don't agree with or why.

And you're right. It's the nail that sticks up that gets pounded down, so never make any waves. But you know, I've spent most of my 70 years being pounded down. *CQ* has dumped on me. *QST* has dumped on me. The IRS dumped on me. An ex-wife dumped on me. Newspaper and magazine articles have dumped on me. I've got tapes of ARRL officials dumping on me at ham conventions. Yet for some reason I keep making waves. Crazy old coot, must be the answer. You'll be a lot safer if you don't send for my stuff.

No Russian Trip For Wayne

I've been hoping I could get to Russia in May with Dave Larsen KK4WW. Outside of the fun of operating from Russia and the Ukraine, I was hoping my expertise in small business development might be helpful. One of their biggest problems is converting from a government-run society to private businesses. I don't know if I could help or not, but it seemed worth trying.

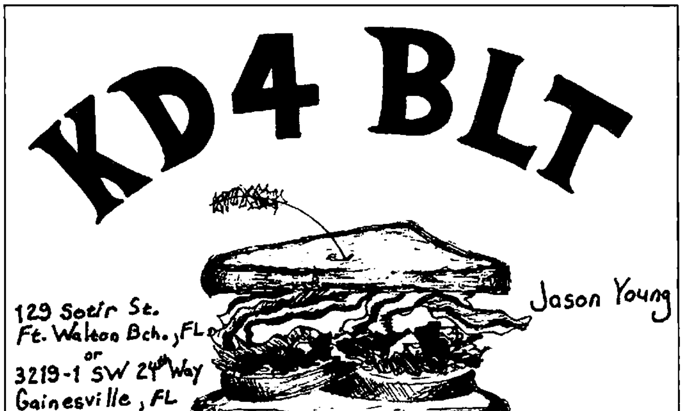
But then as my Economic Development Commission work dragged on months longer than I imagined possible, I had to finally admit that I just wasn't going to be able to get away.

In addition to my Commission work and a serious battle with the six major record companies to keep them from getting a tax put on all digital recording media (which they would split), I'm also starting a new music publication, the *Secret Guide to Free Music*. Plus I'm building up our recording, distribution and mail order businesses. The recession has hit the music industry too, so that means more work for a while.

Perhaps by 1993 I'll have things more in hand and be able to get away. Perhaps by then the Russian countries will be settled down a bit and be better able to use my guidance. Things are probably in such a turmoil right now that I wouldn't be of much help. I think that only Moscow has really started encouraging small businesses to be formed.

Still, I sure enjoy working the pileups. I love whittling 'em down, right on down to the mobiles and QRP ops. Doing the QSLs isn't as much fun.

I had another DXpedition offer to Sakhalin Island...you know, where they shot down the Korean airliner. I just don't have the time...sigh. Now why didn't I retire like everyone else when I was 65? 73



QSL of the Month

To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

Number 18 on your Feedback card

QRP

Low Power Operation

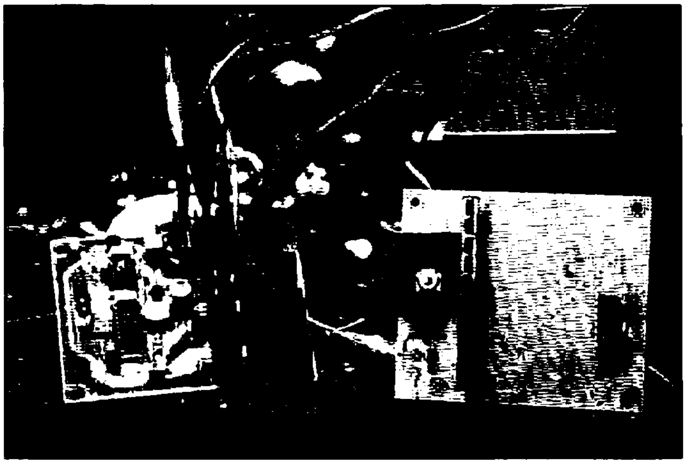


Photo A. Monitor your DC supply with this LED expanded voltmeter circuit (shown on the right).

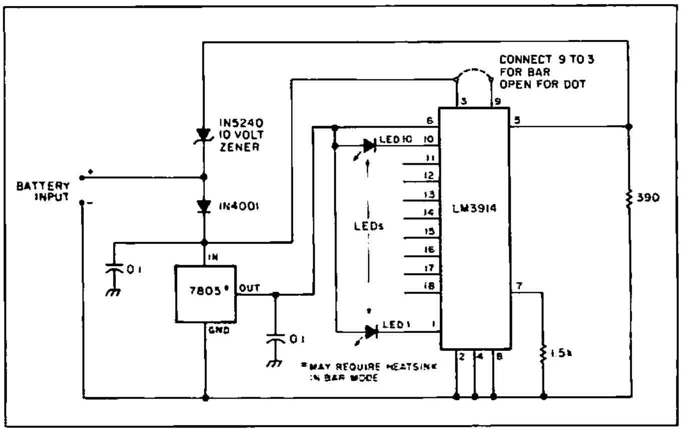


Figure 1. Schematic diagram of the expanded voltmeter.

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

LED Expanded Voltmeter

Can you stand just one more expanded voltmeter? I sure hope so, as this is an easy project to put together and operate. In fact, there is not one single adjustment to be made. What makes this expanded voltmeter special is the 10-segment LED readout. All this magic is carried out by an LM3914 dot/bar display driver IC.

Unlike other chips used today, the LM3914 does only one thing, and that is to light up 10 LEDs in bar mode, or one of 10 LEDs in the dot mode, in response to an input voltage. The LM3914 contains a voltage divider and 10 comparators that turn on in sequence as the input voltage rises. There's also a 1.2 volt reference voltage source inside the LM3914. The LM3914 comes in an 18-pin dual in-line package. Figure 1 contains a simplified version of the circuit of the LM3914. You could build your own version of the LM3914 using LM339 comparators to get a 10-LED bar display, but I don't see any reason why. The LM3914 goes for about $3 at most electronic supply houses.

How It Works

The expanded voltmeter takes advantage of the external reference pins of the LM3914. You can use either the built-in 1.2 volt reference or supply a reference voltage to pin #6 (Rhi) of the LM3914. Pin #4 (Rlow) is the ground return for the divider chain. This is exactly what we're going to do when we build the voltmeter.

The reference voltage we'll feed to the LM3914 comes from a 7805 1-amp regulator. This regulator will also source the LEDs. The +5 volts is placed on pin #6 of the LM3914. The low end of the divider chain is pin 4 and it's grounded. Pin 6 is +5 volts, pin 4 is ground, so we have established 5 volts across the divider. The LM3914 then divides this 5 volts into 10 equal steps, each one 0.5 volts DC. This establishes the full-scale voltage (0–5) of the meter.

The battery voltage is fed to a zener diode. In this case, it's a 1N5240, a 10 volt zener diode. This zener diode subtracts 10 volts from our incoming voltage feed from the battery. The 390 ohm resistor connected in series to the zener diode continually draws current through the zener diode and makes the voltage drop stable. The value of this resistor is not critical. You can use almost any value from 220 ohms up to 1,000 ohms. Use something close if you don't have the 390 ohm resistor in the junk box.

If we use a 12 volt battery, the LM3914 "sees" only 2 volts. The 2 volts are then applied to the input of the LM3914 and, when compared to the 5 volt reference, the chip will then light up four LEDs (in the bar mode). Remember, each LED is worth 0.5 volts, so 2 volts equal four LEDs. By using the zener diode, we have expanded the range of the meter to read 10 volts, no LED on, to 15 volts, or all LEDs illuminated.

The 1.5k resistor on pin #7 of the LM3914 is used to control the amount of current flowing though the LEDs. Since we're feeding the LEDs' anodes from the 7805, we can adjust the value of the 1.5k resistor to suite your liking. Lower the value and the LEDs will get brighter; raise the value and they'll be dimmer. The brighter the LEDs, the more current we'll be demanding from the battery we're trying to measure. If you don't happen to have a 1.5k resistor in your junk box, a 2.2k works very well.

We could have sourced the LEDs directly from the Vcc line, but that would have really put stress on the LM3914. They're kind of expensive chips to be cooking, so stick with the 7805.

To keep the electronic expanded voltmeter from going up in smoke if you connect it to the battery backwards, a simple 1N4001 diode is used. If you hook the meter up backward nothing bad will happen; in fact, nothing will happen at all.

Another feature of the LM3914 and of this project is the ability of the LM3914 to display either a moving dot (one LED at a time) or bar mode (many LEDs at one time). Pin 9 selects either one. When pin 9 is connected to Vcc, we have bar mode. If pin 9 is left floating, dot mode. We should connect pin 9 to pin 11 when using dot mode, but I have not had any trouble just leaving the pin float.

Construction Tips

Because of the number of components used, a small piece of perfboard could be used for construction. However, a lot of mistakes can be made when connecting the LEDs to the LM3914. A ready-made PC board is available from Far Circuits, 18N640 Field Court, Dundee, IL 60118, for $8 plus $1.50 for shipping. A complete set of parts, including the PC board, LM3914, LED strip and the 7805 may be purchased for $19.95 plus $1.50 shipping from me.

Watch the Vcc and ground pins as they are different from many ICs you may be used to using. The Vcc pin is #3 and the ground pin is #2. Remember, the LM3914 comes in an 18-pin DIP package. As the LM3914 is kind of expensive, it would be a good idea to get a socket for it.

The PC board has been laid out to accept a 10-LED strip. This makes a really nice display as all the LEDs are straight and of equal intensity. This strip is available from Mouser Electronics (part number is 351-2011). Of course, you don't have to use the LED strip as regular LEDs may be used. If you go this route, check each LED for brightness before you solder it in the PC board. I mounted the LED strip by inserting a 0.625" long nylon spacer on

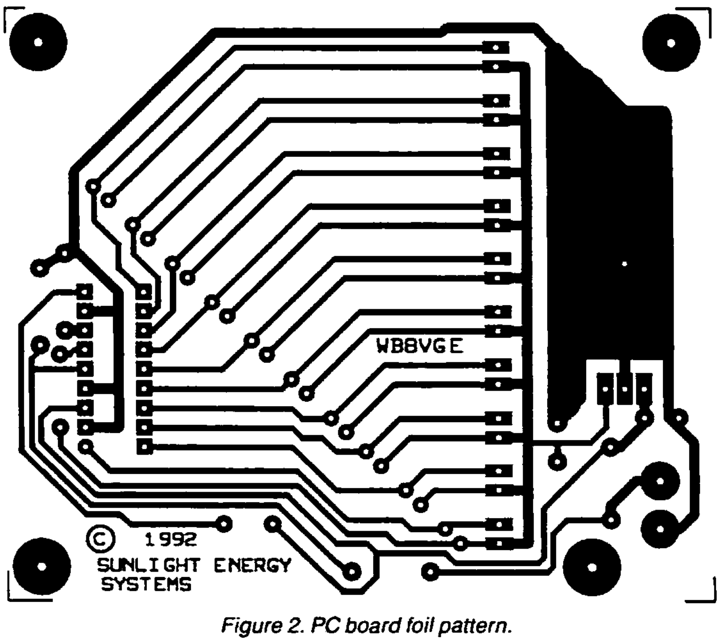


Figure 2. PC board foil pattern.

the first and last LED. This provides support and keeps the LED strip from bending. If you don't use the LED strip, you could use nylon spacers on each LED as well to keep them all upright. It might be a tight fit with all 10 spacers under the LEDs.

If you use individual LEDs, you might want to add some color to the project. The lower voltage LED could be red, some yellow or green in the middle, and red LEDs at the top two positions.

The PC board allows you to install the LEDs either vertically or on a slant. Don't install two rows of LEDs! Doing so will french fry the LM3914.

Install a small heat sink to the 7805 regulator if you use the voltmeter in the moving bar mode. You won't need to heat-sink the regulator if you set the mode to moving dot as only one LED will be on at a time.

Assembly is easy. Stuff the PC board and check out your work. If you want the moving bar display, solder a resistor lead in the two PC holes marked "mode." For the moving dot display, don't use the jumper.

Check over your work before adding juice to the circuit. There's nothing to adjust or set up. Use a variable power supply to test out the voltmeter to verify operation before you connect the meter to a battery. As you raise the voltage, the LEDs will light up (depending on what mode you have the display in). If you have the display in the moving bar mode, at 15 VDC all the LEDs should be illuminate. At 10.5 volts, all the LEDs should be dark.

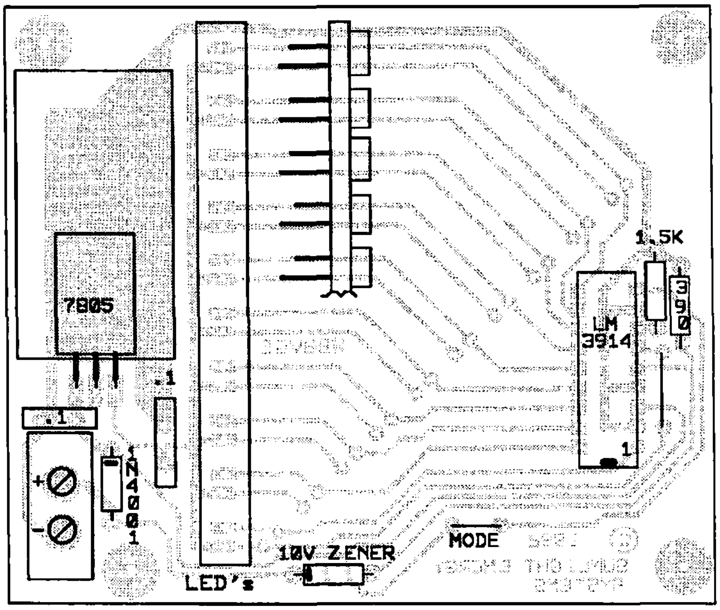


Figure 3. Parts placement.

That's it! But before you button the meter up, you'll have to add some type of scale. I for one can't remember what LED should be glowing at any one time.

Install the meter in a small plastic box. A paper scale was laid out and placed on the front of the box. This method seems to work quite well. Nothing fancy, but it gets the idea across. Start with the bottom LED at 10.5 volts (at 10 volts, all the LEDs are off) and the top (or tenth LED) at 15.5 volts.

If you have the display set as a moving bar, total current for all the meter will be around 130 mA. Moving dot display requires 30 mA. In the moving bar mode, I would not want to leave the meter connected to a small battery very long. This expanded voltmeter would be a great accessory to a variable power supply on your work bench. RVers, as well as mobile operators, might find it useful.

Field Day QRPers can keep an eye on their batteries. You'll find this expanded voltmeter a valuable part of your tool box. 73

Number 19 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

Crystal Matching and Activity Tester

Hams still use crystals for many purposes: VXOs in QRP gear; in matched frequency sets for IF ladder and lattice filters; local oscillator injection to product detectors; as "quick and dirty" RF sources for experimentation, and many other uses. Many different crystals available as surplus are quite inexpensive, and there are a number of crystals residing near the bottom of a number of junk boxes, many of which can be put to use.

Crystals vary in activity and many crystals, especially those in FT-241 and FT-243 holders, tend to age, and both frequency and activity are subject to change over time. Even if they have quit entirely they can be taken apart and washed in alcohol and replaced in their holders. Modern crystals in hermetically sealed metal cases seldom age much and rarely quit operating unless a mechanical shock has broken an internal connection.

This simple circuit allows rapid testing of crystal activity—if the crystal is good, the LED lights. The connector allows monitoring of crystal frequency with a frequency counter, making selection of matched frequency crystals for IF filters a simple matter. Crystals of frequencies from below 1 MHz to over 13 MHz will oscillate readily in this circuit. Crystals oscillate in their series mode, slightly higher in frequency than that marked on the holders.

One-half of a 7400 2-input quad NAND gate TTL chip is connected as an oscillator and is followed by an NPN transistor switch. RF from the oscillator is rectified by a pair of germanium diodes (silicon will also work), filtered, and the resulting DC voltage applied to the gate of the transistor, which causes it to conduct. Collector current then illuminates the LED to indicate that the crystal is oscillating.

A crystal of normal activity will cause the LED to light brightly. If crystal activity is low the LED will be less bright, and the crystal most likely should not be used. If a crystal will not oscillate, the LED will remain dark.

If a very accurate indication of crystal activity is required, the diodes and filter can be fed through a potentiometer into a microammeter to ground. This replaces the transistor switch and LED. The pot will set the meter indication at a reference point on the meter scale with an active crystal in the circuit. Additional crystals will produce a meter indication higher or lower than that established with the first crystal, thus showing they are more or less active oscillators. This is rarely of major importance. The simple GO-NO GO indication with the LED will suffice in most instances.

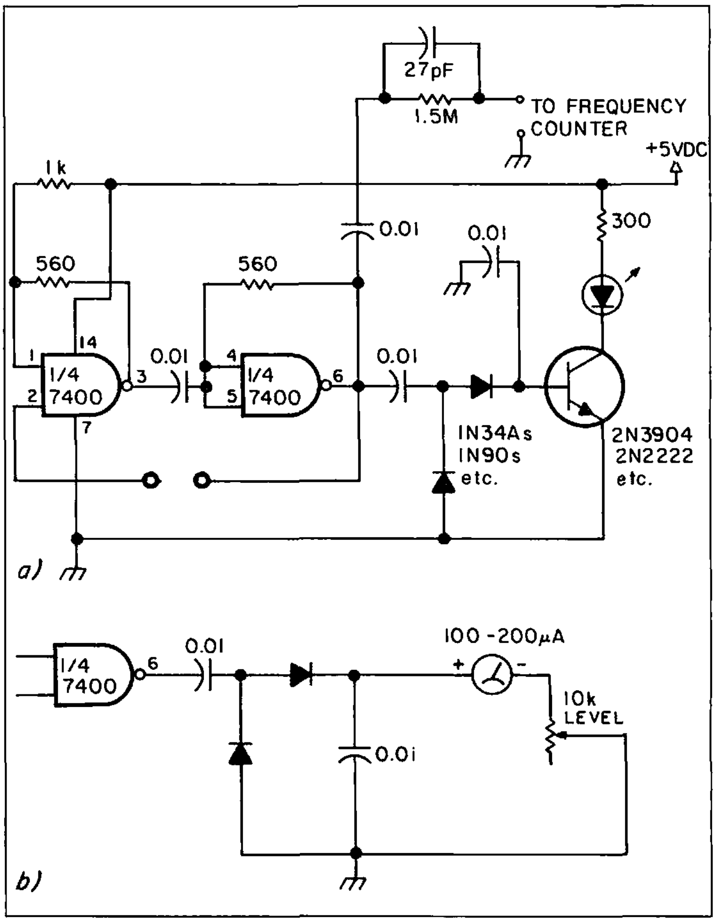


Figure 1a and 1b.

Depending on the type of holders used for the crystals you have, one or more suitable crystal sockets can be paralled for ease of use In testing.

J. Frank Brumbaugh KB4ZGC
Bradenton FL

Number 20 on your Feedback card

DEALER DIRECTORY

DELAWARE

New Castle

Factory authorized dealer! Yaesu, ICOM, Kenwood, Ten-Tec, AEA, Kantronics, DRSI Mfg., Ameritron, Cushcraft, HyGain, Heil Sound, Standard Amateur Radio, MFJ, Hustler, Diamond, Butternut, Astron, Larsen, and much more. **DELAWARE AMATEUR SUPPLY, 71 Meadow Road, New Castle DE 19720. (302) 328-7728.**

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DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '91 issue must be in our hands by February 1st. Mail to *73 Amateur Radio Today*, Box 278, Forest Road, Hancock NH 03449.

RTTY Loop

Continued from page 78

dialects of BASIC, from older interpreted ones to some of the compiled versions of the language now available.

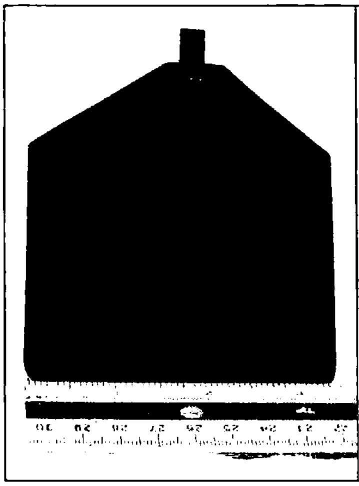
As you can see, I aim to please, with responses to your questions! Next month, we'll try to get through a stack of letters that are gathering dust on my desk. In the meantime, feel free to bug me by mail, on CompuServe (ppn 75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR). I look forward to each and every comment or question, critique or suggestion, about "RTTY Loop." 73

(Program listing continued from page 78)

```
1140 IF WPM>=13 THEN ELE=DIT ELSE ELE=DIT*((CWPM/WPM-
     1)*13+2)/2
1150 RETURN
1160 '
1170 ' display current speed and frequency. return cursor where it was.
1180 COL=POS(0): ROW=CSRLIN: LOCATE 1,60
1190 PRINT " wpm: "; WPM: LOCATE 2,60: PRINT "freq: "; F; "  "
1200 LOCATE 2,5: PRINT WPM; "  "
1210 LOCATE ROW,COL
1220 RETURN
1230 '
1240 ' set MORSE to random value from 0 up to numcodes to select random
     char.
1250 ' force a space character after every fifth time we are called
1260 ' and a newline before every 13 groups.
1270 IF NCHRS=5 THEN PRINT " ";: GOSUB 990: NCHRS=0:
     NGRPS=NGRPS+1
1280 IF NCHRS=0 AND NGRPS=13 THEN PRINT: NGRPS=0
1290 MORSE = INT(RND*NUMCODES)
1300 NCHRS=NCHRS+1: RETURN
1310 '
1320 ' handle F9, the pause control.
1330 COL9=POS(0): ROW9=CSRLIN
1340 LOCATE 24,30: COLOR 16,7: PRINT " Press any key to continue ";
1350 X$=INKEY$: IF X$="" THEN 1350
1360 LOCATE 24,30: COLOR 2,0: PRINT "                          ";
1370 LOCATE ROW9,COL9: RETURN
```

NEW PRODUCTS

Compiled by Hope Currier

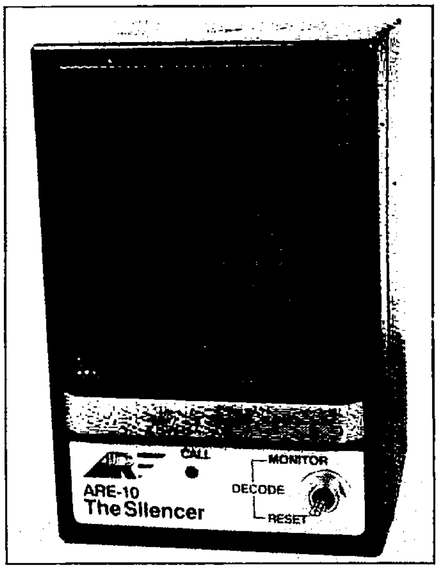


j•COM

New from j•Com is a series of almost invisible antennas for VHF and UHF. The Stealth Antenna is a tiny 3.5" square of 0.003" thick copper-clad polymide coated with a non-corrosive graphite colored coating which adheres to the inside of a car windshield. It looks so much like a decal that it is even available with an optional printed warning symbol to deter would-be thieves and vandals. Thieves in search of a an expensive transceiver to steal are less likely to be attracted to a vehicle that doesn't have a visible antenna.

Despite its incredibly small size, this antenna outperforms a quarter-wave whip under many circumstances. It is an etched copper antenna, multipolarized to reduce QSB caused by the varying polarization of signals received in a moving vehicle. The antenna presents a low SWR over the entire band and requires no adjustments or tuning. Best of all, it can be installed without drilling holes or risking paint scratches from magnets or suction cups. Once installed, it is inside the vehicle, protected from the elements, and never in the way in a car wash or low garage.

The Stealth Antenna is available in models for 146 MHz, 220 MHz, and 440 MHz. The standard model can handle 50 watts of input power and costs $59.95, Including shipping in the continental US. A high power version capable of handling 110 watts is available for $69.95. Sixteen feet of RG-58/U coax is included in the price. For more information, contact your local ham radio dealer or *j•Com, Box 194, Ben Lomond CA 95005; (408) 335-9120, Fax: (408) 335-9121.* Or circle Reader Service No. 201.

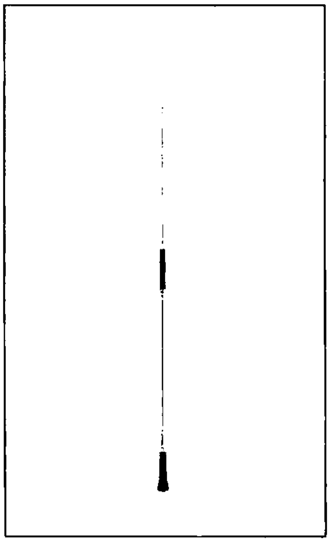


AMATEUR RADIO ENGINEERING

A.R.E. has introduced a new external speaker, plus a 2- to 4-digit DTMF decoder, for use with VHF/UHF radios. The Silencer (Model ARE-10) is user-programmable for a DTMF code which enables (opens) the speaker for approximately 10 seconds when the proper tone is received. When the correct code is received an LED lights on the ARE-10 to tell the user that a call has been received. The ARE-10 allows the user to set the front toggle switch to MONITOR when they want to hear everything being said on the frequency. The toggle switch also has a momentary position which is used to turn the LED off after a call has been received.

The ARE-10 provides a way for everyone to economically have selective calling. It also allows family members or co-workers to avoid hearing everything being said on today's busy frequencies. Rather than turn the radio off to eliminate the annoyance, just set the toggle switch to DECODE and The Silencer will eliminate all of the chatter, while allowing the user to still receive calls. To connect the ARE to a radio, all that is necessary is to plug the ARE-10 into the external speaker jack on the radio and connect its power lead to 12 volts DC. Simple and fast.

The ARE-10 includes a high quality speaker that will improve the audio from today's transceivers. It is compact, measuring just 3" (w) x 3-1/4" (d) x 4-3/8" (h). It is priced at $99.95 and is available from your local amateur radio dealer. For more information, contact *Amateur Radio Engineering, P.O. Box 169, Redmond WA 98073; (206) 882-2837, Fax: (206) 861-5780.* Or circle Reader Service No. 203.



NCG

NCG/COMET Antenna has released the CX-224 2m/220/440 MHz Triband Mobile Antenna, the first ever with gain. The high-quality construction and materials COMET is known for are used to create a durable antenna with excellent appearance and performance. The CX-224 radiates 1/2 wave on 2m with 2.15 dBi gain, a 5/8 wave on 220 MHz with 3.2 dBi gain, and 2-5/8 waves on 440 MHz with 5.5 dBi gain. It is 37" long and is made with a hinged base to allow the element to fold over. It has a PL-259 connector, and is also available with an NMO connector (CX-224NMO). A triplexer is also available: CFX-324A has coax leads, CFX-324B does not; both have UHF connectors. This new antenna and triplexer are now available from most amateur radio dealers, along with a wide variety of trunk-lip, hatch-back and rain-gutter mounts for easy installations.

The introductory price for the CX-224 is $79.95. For more information, contact *NCG, 1275 North Grove St., Anaheim CA 92806; (714) 630-4541, Fax: (714) 630-7024.* Or circle Reader Service No. 202.

MOUSER ELECTRONICS

Mouser Electronics has released a new purchasing manual, #570. This comprehensive reference guide provides up-to-date product data and pricing on over 36,000 electronic components and over 80 manufacturers. Product index tabs are provided for locating particular products quickly.There is a quick index on the front cover. To order your free copy of this catalog, contact *Mouser Electronics, P.O. Box 699, Mansfield TX 76063; (817) 483-0165, (800) 992-9943, Fax: (817) 483-8157.* Or circle Reader Service No. 204.

Number 22 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
% 73 Magazine
Forest Rd.
Hancock NH 03449

Brain Twisters

Well, I knew I was opening a can of worms when I started the topics of modulation and receivers. Folks, the definition of what is going on in modulation has always been somewhat controversial. John WRØW wrote to take me to task on several issues. He points out that the math can be shown to prove that in AM, the carrier *does* in fact change amplitude, and also that it does not! It all depends upon how you look at it. Physically, the same is true. If you look at a modulated AM signal on an oscilloscope, which shows you amplitude versus time, it seems quite clear that the whole signal is changing amplitude, all the way down to zero at times. Yet, if you look at that same signal on a spectrum analyzer, which shows you amplitude versus frequency, you can see the unvarying carrier and the two varying sidebands. How can they both be true?

Perhaps they can be. Consider this: Modulation changes the shape of the carrier wave; if it is changing amplitude, the individual waves can't be perfect sine waves anymore because one side must be getting bigger or smaller. Such changing shapes, when not differentiated by how their energy is spread across various frequencies (as they would be in a spectrum graph), form a net result of change of amplitude *of the total signal*, as the oscilloscope shows. But, when we examine the effects of the shape changes by how the resultant energy is spread across the spectrum (using the spectrum analyzer), it appears that the part of the total energy that is purely sinusoidal (and thus unmodulated) is not changing. OK, I know I'm only adding more controversy, folks. Please don't write complaining about this attempt at an explanation. No one else has ever resolved the issue, and I sure don't expect to be the first! But, as you can see, modulation is rather complex. And, as John points out, FM is even more complex when subjected to mathematical analysis. Thanks, John, for some thought-provoking points.

By the way, John, I, too, have heard very conflicting reports about the proper care of NiCd batteries. The "smart discharger" idea seems great to me, but knowledgable industry folks say no, no, no! The information I presented on the subject came from many years of experience with the annoying little buggers. I, for one, can't wait for nickel-hydride or some other new technology to obsolete NiCds once and for all.

FM-SSB?

Here's another brain twister: SSB transmitters can be used for a kind of FM, and hams do it all the time. Say what?

It's true. SSB, which *really* changes the shape of the carrier in strange ways, has an odd characteristic. If you feed a pure audio sine wave into an SSB transmitter, all you get out is a pure carrier, offset from the dial frequency by the frequency of the audio tone! So, what happens if you vary the frequency of the audio tone? You guessed it, it makes the transmitter's frequency wiggle along with it. Yup, FM! Well, not exactly. In real FM, the carrier frequency deviates proportionally to the amplitude of the audio signal, not its frequency. But the output of this FM-SSB is just like FM as far as thespectrum is concerned; it's a wiggling carrier of constant amplitude. So where do we use it? Well, RTTY, which is Frequency Shift Keying, is a form of two-state FM. It's either at one frequency or the other, with the two frequencies representing digital ones and zeros, or "mark" and "space."

FSK vs. AFSK

True FSK is produced by making the on-off voltages which represent the digital data directly shift the transmitter's frequency back and forth between the two values. This can be done by switching between two oscillators or, perhaps, shifting a PLL. Probably the most common method is to use a varactor diode (varicap). It really doesn't matter.

AFSK, which I suspect is more commonly used these days, relies on the FM-SSB technique I just described: Audio tones are fed into the transmitter, forcing it to produce a carrier which follows the tones.

Spectrally, the two techniques produce *exactly* the same result, but there's a difference in operation. With true FSK, your frequency display shows one of the two frequencies being used (usually "space," or digital zero). With AFSK, your display is offset from the frequencies you are actually putting out because they are both the result of modulation. Thus, they are in the sideband area. So, if you are on 14.080 MHz AFSK (USB), you are actually transmitting around 14.082 MHz. Keep that in mind if you should wander near the band edges. Just like on SSB, you must keep all your sideband emissions within the band. Even with true FSK, you must consider the two frequencies being generated and the sidebands resulting from their generation. A 170-Hz-shift signal is wider than 170 Hz, because it is modulated with the data!

SSTV is a more complex case. In that mode, a constant-amplitude sine wave audio tone is made to frequency

modulate in step with the amplitude of the slowed-down video signal. Then that "audio FM" signal is applied to the SSB transmitter, making it frequency modulate with the frequency of the audio, as described above. The result is that the transmitter's output frequency wiggles in step with the original video signal's amplitude. That, my friends, is real FM. On SSB. On 20 meters. Perfectly legal, too. And it occupies well under the allowed 3 kHz bandwidth, so why not? If it weren't for this system, 252SSTV would be darn near impossible, because the fading, QRM and static would make the video unwatchable. All in all, it's pretty clever.

FM Voice Level

When signals get weak, there's a natural tendency to talk louder. It makes intuitive sense: If someone can't hear you, yell! Actually, it kind of works, up to a point, on SSB. The ALC circuit in the transmitter keeps the loudest speech sounds from overdriving the output (at least it's supposed to), while the softer sounds are raised in level. Sounds like a speech processor, doesn't it? On FM, however, the situation is much different. Before we get to why, we need to look at FM a little more.

How Big Does It Get?

With FM, there is no theoretical maximum modulation as there is with AM and SSB. After all, it's just the frequency of the carrier wiggling, and we can wiggle it as far as we want, right? In practice, there are limits to how far it can go because the tuned RF amplifiers have bandwidth limits. But those limits can be pretty wide, so we can ignore them here.

Without some circuitry to limit the mike gain, we can deviate an FM transmitter into infinity. So just what is "maximum" modulation in an FM system? It corresponds to the maximum deviation which can be turned into a *linear* change in the recovered audio voltage *in the receiver's detector*. This limit is set by the design of the receiver, not by any inherent theoretical characteristic of the transmitter. If the transmitter deviates farther than the receiver is designed to accept, it will cause terrible distortion due to the detector's being unable to remain linear at the extremes. Heck, everything has some limits!

The wider the deviation, the lower the noise level, provided there is plenty of signal. That's because apparent random deviation caused by noise in the transmitting modulator and the receiver's front end represents a smaller percentage of the total. Obviously, if you have 500 Hz maximum deviation (a ridiculously small amount), then a random deviation of, say, 2 Hz is much more serious than if maximum deviation is 15 kHz. So why not use lots of deviation? Two reasons.

First, it takes up lots of bandwidth. Ever wonder why commercial FM stations are spaced at least 200 kHz apart? Commercial stations use lots of deviation, thus lots of bandwidth. Let's see, we could fit 20 stations on 2 meters. . . not too good.

Second, it makes the signal appear much weaker at the receiver because the available energy is being spread over much wider bandwidth, making the amount at any one frequency much less. That's why your favorite FM rock station needs those 100,000 watts to be clearly heard for a 30-mile radius, while you can hear a 100-watt repeater 50 or more miles away. By using narrow bandwidth, we greatly expand range at the expense of fidelity.

"Here's another brain twister: SSB transmitters can be used for a kind of FM, and hams do it all the time. Say what?"

Here's the Why

And that's why yelling on a weak FM link actually makes you *harder* to hear! Have you ever noticed that a weak FM signal, amateur or commercial, gets the most distorted on audio peaks? Just when the cymbal crashes or the voice is the loudest, it sounds the worst. When you deviate your transmitter to the max, your transmitter's energy is spread wider, so it seems weaker. Of course, if you whisper, you may be lost in the noise of the weak reception. There is an optimum level, and it is best found through experimentation with your particular rig. Next time you're real scratchy into the repeater, try talking a little bit *softer* and I'll bet you get heard better! By the way, I have never heard anyone but myself do this, but I promise, it works.

One Last Brain Twister

You've probably heard this one: At certain audio modulating frequencies, the carrier in an FM transmitter actually disappears! Yes, it does, but that does not mean that the transmitter's *output signal* disappears! Before you go grabbing the antenna to see if it is true, consider this: The transmitter is still putting out full power—it's all in the sidebands. You still don't want to touch it. Ouch!

73 and see you all next month! de KB1UM. 73

Number 23 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

MAY 2

GRAND JUNCTION, CO The Western Colorado ARC will hold its annual Hamfest in Lift Auditorium at Mesa State College from 9 AM–2 PM. Seminars. VE Exams. Talk-in on 146.94. Call ***Ernie N0OEQ, (303) 242-6035***, or ***Bob N0OKL, (303) 434-8604***.

EAST LIVERPOOL, OH The Triangle ARC will hold their first annual Hamfest at the Calcutta Fire Hall. Talk-in on 146.10/.70 rptr. Contact ***Dick Sisley K8JKB, Secretary, 1218 Northside Ave., East Liverpool OH 43920.***

SONOMA, CA The Valley of the Moon ARC will hold its semi-annual "ham" and egg breakfast, VE exam, swapmeet, ARRL Hamfest, ATV, packet radio demonstration starting at 8:00 AM at the Sonoma Community Center, 276 East Napa St. Fishing in afternoon. VE exams will be walk-in with registration at 10:00 AM. Testing at 11:00 AM. Swap spaces $10. Breakfast $5. Admission free. Talk-in on 147.47 simplex and 144.75/145.35 rptr. Contact***Darrell WD6BOR at (707) 996-4494.***

MAY 2-3

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention and Hamfest at the Abilene Civic Center from 8 AM–5 PM Sat., and from 9 AM–3 PM Sun. Free parking. VE Exams. Wheelchair access. Tables $5 each. Pre-registration $6 (must be received by Apr. 28), $7 at the door. Talk-in on 146.160/.760. Contact ***Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. (915) 672-8889.***

SIERRA VISTA, AZ The Cochise ARA will hold its annual Hamfest at the club training facility. Drive 5 miles east of town on State RT. 90 and then 2 miles south on Moson Rd. VE exams. Overnight RV camping (no hookups) available to club members. Talk-in on 146.52 or 146.76(-.6). Handicap facilities. Contact ***N7INK (602) 378-3155 after 6 PM*** or write to ***CARA, PO Box 1855, Sierra Vista AZ 85636.***

MAY 3

ST. PETERSBURG, FL The St. Petersburg ARC will sponsor a Hamfest at Lake Maggiore Park (9th St. & 38th Ave. So.) from 8 AM–1 PM. Flea Market. Tailgating. Free Admission. Bring a picnic lunch and eat under the park shelters. Talk-in on 147.06 rptr. Lake Maggiore Park is a city park, so there will be no commercial dealers. Contact ***Robert Russell N4ZMQ, (813) 896-2518.***

NEW CASTLE, DE The Penn-Del ARC will sponsor the Penn-Del Hamfest at the Nur Temple, 198 S. DuPont Hwy., (RT 13 near US 40 split), from 8:30 AM–2 PM, rain or shine. Set-up at 7 AM. Indoor/outdoor reserved swap tables, tailgating, VE Exams, Commercial exhibitors. Indoor tables with electricity, $10; without electricity, $8. Outdoor tables are $6. Tailgating $5. General admission $4. Reservations required for swap tables: send check to ***PO Box 1964, Boothwyn PA 19061***. Make checks payable to ***PENN-DEL ARC***. For info call ***(215) 497-2124.***

MAY 9

MANITOWOC, WI The Mancorad RC will sponsor a Ham/Computer/Flea Market at the Manitowoc County Expo Ctr., intersection of Hwys 42-151 and I-43 on Co. R. from 8 AM–3:30 PM. Set-up at 7 AM. VE Exams, all classes. Camping available via ***Manitowoc Co. Expo Ctr., (414) 683-4378.*** Advance tickets $2, $3 at the door. 8' tables $5 with outlet, $3 without. Talk-in on 146.01/.61. Contact: via SASE to ***Mancorad R.C., Box 204, Manitowoc WI 54221-0204*** or call (days) ***"John" (414) 682-9151;*** (nights) ***"Lou" (414) 682-2557.***

MAY 10

ATHENS, OH The Athens County ARA will hold its 13th annual Hamfest from 8 AM–3 PM at the City Recreation Center. Take the East St. exit on either US Route 33 or US Route 50, and look for signs to the Hamfest. Admission is $4 a person, but in honor of Mother's Day, YLs and spouses of male hams will be allowed in free. Free paved outdoor flea market space adjacent to building for tailgaters and those bringing their own tables the day of the event. Indoor space available by advance registration only. To register, contact ***John Biddle WD8JLM, 80 Wonder Hills Dr., Athens OH 45701. (614) 594-8901*** (after 6 PM). Talk-in on the club rptr. at 145.15+ MHz. For info write to ***Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701-1939.***

WHEATON, IL GMRS of Illinois, Inc., will hold their Bi-annual Fest from 8 AM–1 PM at the DuPage County Fairgrounds, Manchester Rd. Set-up will begin at 6 AM. Advance tickets $4; $5 at the door. Tables $10 each. Free outdoor Flea Market spaces. Ladies admitted free. For info call ***Bob, (708) 690-1492.***

MAY 15-17

VENTURA, CA The 1992 West Coast VHF/UHF Conference, sponsored by the Ventura County ARC, will be held at the Holiday Inn on the Beach, 450 East Harbor Blvd. Free parking. Take advantage of the special hotel Conference Rate of only $55 per night, double occupancy (plus room tax). Be sure to mention the conference. Offer valid until May 1. Hotel reservations: ***1-800-842-0800***. Sat. night Banquet $25 (pre-register only). Sun. morning Breakfast, $10. No-Code Tech class and Exams, call ***(714) 979-2633.*** There will be a list of proceedings available at the Conference for $10. Make checks payable to ***Ventura County ARC*** and mail payment to ***VCARC, PO Box 2103, Oxnard CA 93033.*** For info call ***(805) 647-4294.*** No refunds after May 6. For exhibit space call ***(805) 264-1978.***

MAY 16

COLORADO SPRINGS, CO Pikes Peak RAA will host the largest Ham-Computer Swap in Colorado from 8 AM–4 PM. Admission $3. Tables $10. Contact ***At N0CMW*** or ***Frances N0IUT, (719) 473-1660.*** Write: ***PPRAA, PO Box 16521, Colorado Springs CO 80935.*** VE Exams. Free Parking. Take Filmore Exit East off I-25 to Union, then right to Mega-Mart, 1801 Union Blvd. Talk-in on 146.37/.97 or 146.52.

EPHRATA, PA The Lancaster County Hamfest, sponsored by the Ephrata Area Repeater Society, Inc., will be held at the Ephrata Senior High School, 803 Oak Blvd., beginning at 8 AM. Set-up at 6:30 AM. All sites handicap accessible. VE Exams at 9 AM. Admission $4. Tailgating $3. Inside tables $6. Talk-in on 145.45 MHz, 146.52 MHz and 444.65 MHz. For info and reservations, call ***Tom Youngberg K3RZF, (215) 267-2514*** after 6 PM; or write ***E.A.R.S., 906 Clearview Ave., Ephrata PA 17522.***

CADILLAC, MI The Wexaukee ARA will hold their annual Swap and Shop at the Cadillac Middle School, 500 Chestnut St., from 8 AM–1 PM. Admission $3. Tables $6. Talk-in on 146.38/.98 rptr. Call ***Dan Schmidt KE8KU, (616) 775-0998;*** or write ***Wexaukee ARA, PO Box 163, Cadillac MI 49601-0163.***

NO. SMITHFIELD, RI The Rhode Island Amateur FM Repeater Service, Inc., will hold their annual Spring Auction and Flea Market at the VFW Post 6342, Main St., beginning at 8 AM. Take the Forestdale exit off Route 146 in No. Smithfield, take a left at the end of the ramp and go six tenths of a mile to the Post (on your right just before the Village Haven Restaurant). Flea Market spaces $5 each. There will be an auction from 11 AM–3 PM. Donation $1. Talk-in on 146.76. For info contact ***Rick Fairweather K1KYI, 106 Chaplin St., Pawtucket RI 02861***, or call ***(401) 725-7507*** between 7 and 8 PM.

AMENIA, NY A Hamfest sponsored by the Southern Berkshire ARC, will be held at the Amenia NY Firehouse (US Rte 44 or NY 22 to Amenia stoplight, east on 343 one block to Mechanic St., to the firehouse. From Connecticut, west on Rte 4 to Sharon, then west on 343 to Amenia. Pavilion tables $4. Admission $3. Talk-in on 147.285/.885. SASE to ***Ed Wilbur WB1CEI, PO Box 547, Sharon CT 06069. (203) 364-5206*** eves.

KLAMATH FALLS, OR The First Annual South Central Oregon Hamfest will be held at the Oregon Institute of Technology campus. Exhibitor booths, Flea Market tables, lasers, and license exams for all classes, are among the events planned. 10' tables $10 each. Contact ***Hollis Kiger W7UFM, (503) 882-5129*** or ***Dick Switzer KB7DWX, (503) 882-1300.***

MARSHALLTOWN, IA The Central Iowa RAS will hold its Hamfest at the Marshalltown Community College–1/4 mile south of HWY 30 just east of HWY 14. Talk-in on 146.28/.88. VE exams, sign up at 10:00 AM–2 PM. For info call ***Chuck Dennis WB0ZKG, Toledo IA. (515) 484-4837.*** Tickets $3 in advance and $4 at the gate. Call or write ***Charles Lynk W0DYS, 2460 Reed Ave., Marshalltown IA 50158. (515) 753-6925*** or ***Brian Krumm N0MXK, 911 South 8th Ave., Marshalltown IA 50158. (515) 752-9658.*** Tailgating.

MAY 16-17

HARTWELL, GA The Lake Hartwell Hamfest will be held at Hartwell Group Camp Sat. and Sun. ARRL sponsored VE Exams for all classes will be held on Sat. the 16th.

BIRMINGHAM, AL The BirmingHamfest will be held indoors at the Birmingham-Jefferson Civic Center. Talk-in on W4CUE/R, 146.880 MHz. Commercial exhibitors, Flea market, Electronic equipment, Awards, Amateur radio license tests (Sunday only). Adult admission $5. Reservations and information, Write: ***BirmingHamfest '92, PO Box 94775, Birmingham, Al 35220*** or call ***(205) 979-7039***

May 17

WHEELING, WV The Triple States RAC will sponsor the 1992 TSRAC Wheeling Hamfest/Computer Fair from 8 AM–3 PM at Wheeling Park.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot—Flushing Meadow Park, 47-01 111th St., Queens NY. Doors open for Vendors to set-up at 7:30 AM; Buyers admitted at 9 AM. Free Parking. Admission by donation; Buyers $5, Sellers $8 per space. Talk-in on 445.175 NB2A rptr. Contact (eves.) ***Charles Becker WA2JUJ, (516) 694-3955*** or ***Arnie Schiffman WB2YXB, (718) 343-0172.***

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society, and the Harvard Wireless Club will co-sponsor a Tailgate Flea Market for electronics, computer and amateur radio, from 9 AM–2 PM (rain or shine) at Albany and Main St. Free off-street parking. Covered tailgate area for 400 sellers, $8 per space at the gate; $5 in advance (includes 1 admission). Set-up at 7 AM. For reservations or info call ***(617) 253-3776***. Mail advance reservations before May 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/444.725-pl 2A, W1XM rptr.

SACRAMENTO, CA The North Hills RC will hold Hamfest '92, starting at 8 AM PST, at the Carmichael Elk's Lodge at Hackberry Lane and Cypress Ave. Talk-in will be on the K6IS rptrs. on 145.190 MHz and 224.400 MHz. Inside tables and outside spaces are available. There will be demonstrations of Oscar, Packet, and ATV. Admission $1. This is the BIG ONE in the Sacramento Valley Section.

May 17-19

PEOTONE, IL The Kankakee ARS will hold its annual Hamfest at the Will County Fairgrounds on May 19 from 8 AM–2 PM. Indoor exhibit area, ARRL booth, large outdoor flea market. Free Parking. Set-up May 17 from 6 AM-8 AM. Admission $3.50 in advance, $4.00 at the door. Take I-57 south of Chicago. Exit 327 east to Peotone. Fairgrounds one mile on left. Talk-in on 146.34/.94. More information from ***KARS C/O Frank DalCanton KA9PWW, 117 Kristina Dr., Bourbonnais, Il. 60914. (815) 932-5950 after 7 PM CST***

May 22-24

TULSA, OK The Green Country Hamfest will be held at the Maxwell Convention Center in down-town Tulsa, located on W. 7th St. between Denver and Houston Avenues. Large indoor flea market, new equipment dealers, forums, V.E. exams, alternate activities for non-amateurs. Admission $8 in advance/$10 at the door. Free parking. Flea market tables $6 in advance and $8 at the door. RV parking. Talk-in on 146.28/.88 Tulsa Rptr. Hamfest information ***(918) 272-3081. PO Box 470132 Tulsa, OK. 74147-0132***

May 23-24

YAKIMA, WA The Yakima ARC W7AQ will sponsor the Washington State Hamfest and the 1st Annual NW Packet Radio Conference. Seminars for all levels of packet radio. VE testing for all levels on Saturday, May 23rd at 1:30 PM. Walk-ins will be accepted. New dealer displays as well as swap/shop tables. Early Bird Breakfast, Sat. and Sun. at 7:30 AM. Banquet Saturday evening at 6:30 PM. Cost $10.50 per person. Talk-in on 146.06/.66. Take 16th Ave. exit off HWY 12, South on 16th to Chestnut Ave., East on Chestnut to 14th, South on 14th to Entrance of St. Paul's School Gym. Admission $5 in advance, $6 at the door. Contact ***Dick Umberger N7HHU, W7AQ Yakima ARC, PO Box 9211, Yakima, WA 98909, (509) 453-8632 days.***

May 24

YOUNGSTOWN, OH The Twenty Over Nine Radio Club is sponsoring a Hamfest at the Canfield Fairgrounds from 8 AM–3 PM. Tickets are $3 in advance and $4 at the door. Indoor tables are $8. Flea market $1. Security provided. Free parking. Talk-in on 147.315. For directions 145.275. Contact ***Twenty Nine Radio Club, 42 South Whitney, Youngstown OH 44509.***

May 31

MILFORD, CT This schedule for 1992 Exams-By the Coastline ARA. All class Exams. Contact: ***Gary NB1M (203) 933-5125-West Haven*** or ***Dick WA1YQE (203) 874-1014-Milford.*** Place: Fowler Building, 145 Bridgeport Ave., Milford CT. Time: 12 Noon. Walk-Ins.

June 6

TEANECK, NJ The ARRL Hudson Division Convention Co-Sponsored by the Bergen ARA, Radio Amateur Telecommunications Society, and the Hudson ARC will be held at the Fairleigh Dickinson University from 7:00AM–4:00PM. ARRL and FCC forums, technical seminars, VE testing, Hamfest. Admission $5, children under 12 free. Vending space $30 per indoor space, $10 outdoor tailgating space, $25 per outdoor space with power. From NYC take Rt. 4 West to River Rd. exit in Teaneck, follow signs to convention. From Rt. 4 East, take River Rd. exit and follow signs. Talk-in on 146.790-6 and 146.700-6. Contact ***Jim Joyce K2Z0, (201) 664-6725.*** For VE info, call ***Pete Adely K2MHP, (201) 796-6622.*** Please, no calls after 10 PM.

June 7

CHELSEA, MI The Chelsea ARC will sponsor a SWAP 'N SHOP. Talk-in:146.980 Chealsea Rptr 8' tables $9, trunk sale $3 per space, special handicapped parking. Gates open at 6:00 AM for sellers. Donation: $3. YL'S, XYL'S, & kids under 12 free. Ladies tables welcome. For more info send SASE or call ***(313) 475-1795, Robert Schantz, 416 Wilkinson Street, Chelsea MI 48118.***

NEWINGTON, CT The Newington ARL will hold its annual amateur radio and computer hamfest from 9:00 AM–2 PM at Newington High School, Rte. 173 (Willard Ave.) just north of Rts. 173 (Cedar St). Tailgating (weather permitting), refreshments, guided tours of ARRL HQ and W1AW. VE exams (no walk-ins). Talk-in on 144.85/145.45, 223.24/224.84, 443.05/448.05, 146.52. Admission $3. Tables $10 in advance, $15 at the door. Contact ***Les Andrew KA1KRP, c/o NARL, 68 Wildermere Ave., Waterbury CT 06705, (203) 523-0453 (SASE for confirmation).*** Exam Appointments: SASE to ***Susan Fredrickson WM1B, PO Box 165, Pleasant Valley CT 06062.***

MANASSAS, VA The Ole Virginia Hams ARC will sponsor the Manassas Hamfest and Computer Show at the William County Fairgrounds. Take 166 west to Rte. 234 then south on 234 to Fairgrounds. Open to public at 8:00 AM, Tailgaters 7:00 AM. Admission $5 each. Tailgating $5 additional per space. Wheelchair accessible. Talk-in on Manassas rptr. 146.37/.97 and 223.06/224.66. Commercial vendors contact ***Woody KD4DEG at (703) 368-5180.*** Contact ***Rosemary KI4VO at (703) 361-5255.***

PITTSBURGH, PA The Breeze Shooters will host their 38th annual Hamfest/Computerfest at the Butler County Farm Show Grounds, on PA. RT. 68 west of Butler. Admission $1 per person at the gate. Free parking. Free tailgate vending. Handicapped parking. Tables $10 each by prepaid reserva-

tion. Contact ***Rey Whanger W3BIS, Box 8, RD#2, Cove Road, Cheswick PA 15024. (412) 828-3694***

SPECIAL EVENT STATIONS

May 1-2

BAKER, CA The Ancient and Honorable Order Of E Clampus Vitus, Billy Holcomb Chapter ARC will operate a special event station KC6LUC from 1700Z-0400Z to commemorate **"The Historical Chicago to Los Angeles Route 66."** Operations will be in the General 40, 20, 15 and the Novice portion of 10 meters. For a Certificate, send QSL and SASE to ***ECV ARC, 1458 Albright Ave., Upland, CA. 91786***

May 2-3

MEMPHIS, TN The Mid-South ARA will operate W4EM May 2 1300Z-0500Z May 3 to celebrate Memphis in May International Festival. This year's honored country is Italy. Operation will be in the lower 50 kHz of the SSB General 80-12 meter and the Novice 10 meter subbands. For certificate, send QSL and a 9 x 12 inch SASE to ***Mara W4EM, 2966 Cordell, Memphis TN 38118.***

May 6-7

SIOUX CITY, IA The Siouxland ARA will operate KØAAR from 1500Z-2100Z to celebrate the 120th anniversary of the 1500 mile steamboat river race between The Nelle Peck and The Far West. Phone: 7.243, 14.255, 21.355, 28.355. For certificate send SASE to **KØAAR, 3407 Jennings St., Sioux City IA 51104**

May 8

FRANKLIN, MA Tri County AR will operate WW1H 1400Z-2100Z to Commemorate the 15th Anniversary of Tri County Regional Vocational Technical High School. Operations will be in the lower end of the 10 meter Novice phone band and the 20 meter General phone band. For certificates, send QSL and a SASE to ***WW1H Tri County Amateur Radio, 147 Pond Street, Franklin MA 02038.***

May 8-9

FORT PIERCE, FL The Fort Pierce ARC will operate KN4RY; 1600Z-2300Z May 8 and 1400Z-2100Z May 9 to commemorate the 5th Annual Trail Ride of the Florida Cracker Trail Assn. Operation will be in the 40, 20, 15, and the Novice portion of the 10 meter phone band. For Certificates please send a QSL and large 9 x 12 SASE (2 units of postage) to ***W3DHN, 18 Cordillera, Fort Pierce FL 34951.***

May 9-10

LAS VEGAS, NV The Nevada QSP Party sponsored by the Frontier ARS will be held from 0000Z May 9 to 0600Z May 10. Work stations once per band per mode. Exchange RS(T), and State/Province/Country (Nevada Stations also give county). Frequencies: 6 through 160 meters modes-CW/SSB/RTTY/SSTV/PACKET. Scoring-1 Pt. Phone QSO, 2 Pt. other modes. Non-Nevada Stations multiply by number of Nevada Counties, Nevada Stations multiply by State/Province/Country Total. Awards-Certificates to top score each State/Province/DXCC Country General and above, Novice & Tech. Mail Entry By June 1, 1992 to:***Jim Frye NW7O, 4120 Oakhill Ave., Las Vegas, NV 89121.***

GRAYS HARBOR, WA The Grays Harbor ARC will be conducting a special events station commemorating the 200th anniversary of the discovery of Grays Harbor. On May 7th, 1792, Captain Robert Gray, in his ship Columbia, sailed into the harbor. Look for W7ZA from 0000Z, May 9th to 2400Z May 10th on the bottom part of the General phone band on 15 thru 80 meters, on Novice phone portion of 10 meters and 40 up from the bottom of the CW bands on 10 thru 80. For a special QSL card please send your QSL card and a SASE (Legal Size) to:***ARS:KA7AIR Joe Ledesma, 516 6th Street, Hoquiam, WA 98550.***

MOUNT VERNON, VA Members of the Mount Vernon ARC will operate 1400-2100Z from locations on the original Mount Vernon estate of George Washington to celebrate the 250th anniversary of the founding of Fairfax County, VA. CW-7.130, 14.040, 21.110; Phone-7.227, 14.250, 21.325, 28.325; VHF voice 146.655; and VHF and HF packet on 145.670 (DCA and WASHDC nodes). For certificate, send QSL and a 9 x 12 inch or #10 SASE to ***Steve Schneider WB4EEA, 8602 Cushman Place, Alexandria VA 22308.*** DX stations send 2 IRCs with QSL and SASE. QSL card confirmation will be sent in addition to certificate only if specifically requested.

WALL TOWNSHIP, NJ The Ocean-Monmouth ARC will be sponsoring the Commemoration of Marconi's Memorial Tower Radio Sight Circa 1914. Omarc will operate KC2Q from 1600Z on May 9 to 1900Z on May 10. Phone at the low end of the General portion of the 15-75 meter band, Novice portion of 10 meter band, CW will be on 3545, 7045, 14045, 21045 MHz. For flat certificate, send 1 green stamp, or SASE for folded, to ***Omarc, PO Box 75, Bradley Beach NJ 07720. Visitors welcome. Talk-in 145.110-600.***

May 10

PROMONTORY, UT The Ogden ARC will operate KE7QV from driving of the Golden Spike, Promontory Summit, UT: operations will be from 0001Z-2100Z on one of the following: 3.970, 7.270, 14.280, 21.375, and 28.415 MHz. Send QSL and SASE to ***Ogden ARC, PO Box 3353, Ogden UT 84409.***

May 13

TOWNSVILLE, AUSTRALIA The National commemoration of the 50th Anniversary of the Battle of the Coral Sea. During May 1-13, a special event callsign, VI4BCS (Victor India Four Battle Coral Sea), will be activated from the Club's premises at Green St., West End, Townsville. A special QSL card will be available for all QSO's to VI4BCS. Celebrations include a troop train from Brisbane bringing 300 ex-servicemen and women to Townsville, arrival of four United States Navy ships and three Australian Navy Ships on May 8 to unveil the $100,000 Coral Sea memorial in Anzac Park. Please phone ***Bob Mann VK4WJ on (077) 797869*** or ***Roger Cordukes VK4CD on (077) 740221*** or write to ***TARC Inc, P.O. Box 964, Townsville, 4810 Australia.*** Packet Address: ***VK4WIK4AFS#NQ. QLD.AUS.OC***

May 14-15

FORT MCCLELLAN, AL 1992 marks the Golden Anniversary of The WAC and the WAAC. The reunion will be held at the historical home of the Women's Army Corps. This year's celebration honors Maj. Gen. Mary E. Clarke. Two-way radio communications on MARS and Amateur Radio frequencies. Certificates will be awarded to all WAC's and WAAC's who participate in the reunion on the air. A QSL card will be sent for the radio operators who assisted them. The station will operate on 28.350, 21.350, 14.285, 7.272, and 3.900 MHz using the callsign N4MOK. Contact the ***WAC Foundation at (205) 848-3512*** or the ***Fort McClellan Army MARS station at (205) 848-4818.***

May 16-17

GLASGOW, KY The Mammoth Cave ARC and the Kentucky Colonels ARC will operate KD4SS from Barren River State Park to commemorate the Kentucky Bicentennial and can be found in the General portions of 10 thru 80 meters. Operation will begin at 1700Z on May 16-1700Z on May 17. ***QSL KD4SS, 309 East Main Street, Glasgow KY 42141.*** SASE please.

RALEIGH, NC The Raleigh ARS will operate W4DW to celebrate the bicentennial of the capital city, from 1500 UTC-2200 UTC on both days. Operation will be in the General portion of the voice bands on 20, 40, and 75 meters, and the Novice portion of 10 meters. For commemorative QSL card send a #10 SASE to ***RARS 200, PO Box 17124, Raleigh NC 27619.***

ST. CHARLES, MO The St. Charles ARC will operate WBØHSI from 1300Z to 2100Z as part of the Lewis and Clark Rendezvous. We will transmit on 7265, 14265, 21365, 28465, 146.67, and AO-13 145.935 (mode B) and 435.970 (mode J) as propagation and QRM permit. For 8.5 x 11 certificate, send a large SASE to the ***St. Charles ARC, PO Box 1429, St. Charles MO 63302-1429.***

WINFIELD, IL The DuPage ARC will operate club station W9DUP, to commemorate Armed Forces Day. Operation will be from the Cantigny War Museum. This event is from 1600 UTC-2300 UTC. Suggested frequencies are 7.250, 14.290, 28.400 SSB and 145.25 (-.600). For a certificate, send QSL and SASE to ***Jack Carr NV9S, DARC PO Box 71, Clarendon Hills IL, 60514.***

May 16-18

HOUSTON, TX The Brazos Valley ARC will operate WD5DRB from 0000Z May 16-0000Z May 18 to celebrate B-VARC's 15th Anniversary. Operation will be in lower 25 kHz of the General 80, 40, 20, and 15 meter subbands, and 28.488 MHz of the Novice subband, with special endorsement for past or present B-VARC members with callsigns. For a certificate, send QSL and SASE to ***B-VARC, PO Box 1630, Missouri City, TX 77459-1630.***

SOUTHFIELD, MI The 1992 QSO Party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Frequencies CW: 1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone: 1855, 3805, 7280, 14280, 21380, 28580. VHF: 50.125, 145.025, 146.52. Scoring: MI Stations: 1 point per QSO X (States + Countries + Michigan counties) on phone. VE counts as a country. Five points for each W8MB contact. Non-Michigan Stations: QSO points X Michigan Counties. One point for each Michigan phone QSO and two points for each CW contact. Five points for each club station contact with W8MB/W8MB/mobile. No rptr. contacts are allowed. Awards. Certificates. Send logs to ***Mark Shaw K8ED, 27600 Franklin Road, Apt. 816, Southfield MI 48034.***

May 17

CRESSKILL, NJ The Bergen ARA, in conjunction with Camp Merritt American Legion Post 21, will operate K2UFM from 1300Z-2100Z to celebrate the 75th anniversary of Camp Merritt and the Rededication of the Camp Merritt Memorial Monument. Operation in General phone portion of 40-80-20-15 meter bands and the Novice portion of the 10 meter band. For certificate, send QSL and SASE 9 x 12 envelope to ***Warren P. Hagar K2UFM, 31 Forest Drive, Hillsdale NJ 07642-1351.***

May 22-June 14

WIESBADEN, GERMANY The Wiesbaden Germany ARC will operate station HB/0DA1WA during its 17th annual DXpedition to Liechtenstein. Operation will be 24 hr/day on all bands 160m through 10m, SSB and CW. QSL card will be printed and should be through DJØLC for stations outside the U.S. and Canada, or through KN6G for stations within the U.S. and Canada. Please send SASE. Contact ***Ronald H. Kellerman DA1RO/KD4DNA, 435 TAW/WXF, PSC 5, Box 38 APO AE 09057.***

May 23-24

SUMTER, SC The Sumter ARA will hold its Iris Festival May 23 & 24 2000 UTC-2000 UTC. Station call: WA4UMU. Lower 10 kHz of General bands: 10m, 15m, 20m, & 40m. Lower 10 kHz of Novice/Tech. Band: 10m. Communication Mode: Voice only (all Bands) QSL Certificates available with SASE. Contact ***Sumter ARA, PO Box 193, Sumter, SC 29150-8862***

WATSON, IL The National Trail ARC will operate at the annual Memorial Day Homecoming. Effingham County. 28.4 + and lower General phone bands. For QSL, SASE. To Callbook: K9UXZ

May 28-31

GREENWOOD, NOVA SCOTIA The Greenwood ARC is operating the Special Event Station VE1RCAF Jan. 1-Dec. 31, 1992 to celebrate the 50th Anniversary of Canadian Forces Base. For commemorative QSL (and possible certificate) send QSL and SASE (CDN) or SA envelope and IRCs to ***Greenwood ARC, PO Box 63, Greenwood Nova Scotia, Canada, BOP INO.*** QSLs sent via Bureau will receive QSL card only via Bureau.

June 1-7

PADUCAH, KY The Paducah ARA will operate W4NJA/KY200 to commemorate the Commonwealth of Kentucky Bicentennial Celebration. CW and Phone, 25 khz from bottom of General/Novice bands. for special QSL, send SASE to ***KC4ENA, PO Box 1732, Paducah KY 42002-1732.***

June 6

GUELPH, ONT. CANADA CENTRAL ONTARIO AR FLEA MARKET will be held at Bingeman Park, Kitchener Ontario Canada. Contact ***Ray Jennings VE3CZE, 61 Ottawa Cres. Guelph, Ont. Canada, N1E-2A8 (519) 822-8342.***

June 6-7

SIOUX CITY, IA The Siouxland ARA will operate KØAAR from 1500Z-2100Z, to celebrate the 120th anniversary of the 1500 mile steamboat race between The Nelle Peck and The Far West. Phone 7.243, 14.255, 21.355, 28.355. For Certificate send SASE to ***KØARR, 3407 Jennings St., Sioux City IA 51104.***

Number 24 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

PUFF, a Microwave Design Program

Last month I described components for use with microwave circuitry. I wanted to describe the special chip capacitors and resistors needed for low-loss conversion at microwave levels to help you select components that won't hinder you at microwave frequencies. I covered examples of non-microwave capacitors and described how to recognize them. This month I want to do a short recap of this information and then go on to a new topic: PUFF, the microwave design program from Cal Tech.

The capacitors needed to achieve high performance at the 5.6 GHz and 10 GHz microwave frequencies are those that are supplied from ATC (American Technical Ceramics), style ATC-100; Johanson, type S-910; and Dielectric Laboratories C11 series capacitors. These chip capacitors are sized for microwave strip line construction and have very low equivalent series resistance (ESR), making them suitable for microwave operation. There are other companies that manufacture chip capacitors that are quite good. I will provide information on them as soon as I receive the data sheets.

PUFF

So much for the capacitors. Let's get started with PUFF. This program is made for microwave circuit analysis and I hope you had time to order your copy and try it out. I am quite excited about PUFF because it allows you to construct microwave circuits. It is not just limited to amplifier construction; filters, patch antennas and many other two- or four-port devices can be constructed in strip line format. In the past I had to rely on published microwave circuitry from other designers, and I had to use the devices they selected. With PUFF, all that changed. Now I can design for devices I have on hand, modifying the circuit to my requirements. I can't overstate my excitement over PUFF's ability to re-design circuitry to suit whatever GaAsFET you might have on hand. All you need is the "S" parameters to pull the design off. This makes PUFF a very powerful engineering tool to have on hand. Let's cover some of the beginning steps required to design an amplifier from scratch. In actual use, the projected performance of my projects matched well with actual measurements, giving PUFF a five-star rating in my book.

If you want an amplifier to put in PUFF, use the test example shown in Figure 5. It gave 14 dB gain at 10 GHz. This amplifier needs some more work to improve the input return loss (s11). See what you can do with it as it has all the parts in "F4" to get you started.

Kerry N6IZW did the original work using PUFF, and I did the reproduction "silk-screening" of the printed circuit boards directly from PUFF's artwork printer dump. (We used a laser printer for high quality.) The circuit we designed was for a 10 GHz amplifier using an NEC-04583 GaAsFET. We selected this device for purely amateur reasons: They were available in surplus for modest prices and we had a few already on hand. Normally this device is quite costly, being space-certified, but being a discontinued device made surplus a good choice. A modest surplus quantity still exists and I will make them available while the supply holds out for under $10 per device. I also have some of the finished PC boards if you do not want to construct your own. Please note: You do not need to use the NE04583 device. You can use whatever device you have on hand as long as you have the S parameters for that particular device. You can design your own circuit using the samples I provide for a guide.

Starting PUFF requires an IBM or compatible computer with 640 kilobytes of memory and DOS-3.0 or later. Monitors supported are CGA, EGA, and VGA. Both Kerry and I had difficulty using the EGA drivers in PUFF, but the other modes worked great on the many different types of systems that we tried.

We had difficulty using 386 33 MHz computers. The program is loaded by typing PUFF at the DOS prompt. This will load the EXE file and bring up the setup.puf file to demonstrate some of the capabilities of the design program.

In actual use, save the master setup.puf file and do not alter it. On a saved copy of this file you will need to use your word processor to make the necessary changes required for your particular circuit configuration. This includes the type of device you are using and all parameters needed for this particular design, board size, dielectric used, etc. Note: The original setup.puf file uses a PC board dielectric of "10" for ceramic substrate. Most designs we use require this to be changed to "2.5" to reflect TEFLON. I suggest you look at Figure 1, "Original Setup.puf" and Figure 2, a modified file for a 10 GHz amplifier using 2.5 dielectric PC board material. Kerry renamed the file something we would remember easily for this particular type of device, in this case the new setup.puf file is NE04583U.PUF. Comments in the setup file can be inserted behind the braces, as shown in Figure 1 or 2.

```
\b(oard} {.puf file for PUFF, version 2.0}
d      0     {display: 0 VGA or PUFF chooses, 1 EGA, 2 CGA,
3 One-color}
o      1     {artwork output format,0 dot-matrix, 1
LaserJet, 2 HPGL file}
t      0     {type: 0 for microstrip, 1 for stripline, 2 for
Manhattan}
zd   50.000  Ohms {normalizing impedance. 0<zd}
fd    5.000 GHz   {design frequency. 0<fd}
er   10.200       {dielectric constant. er>0}
h     1.270 mm    {dielectric thickness. h>0}
s    25.400 mm    {circuit-board side length. s>0}
c    19.000 mm    {connector separation. c>=0}
r     0.200 mm    {circuit resolution, r>0, use Um for
micrometers}
a     0.000 mm    {artwork width correction.}
mt    0.010 mm    {metal thickness, use Um for micrometers.}
sr    0.000 Um    {metal surface roughness, use Um for
micrometers.}
lt    0.0E+0000   {dielectric loss tangent.}
cd    5.8E+0007   (conductivity of metal in mhos/meter.}
p     5.000       {photographic reduction ratio.
p<=203.2mm/s}
m     0.600       (mitering fraction.  0<=m<1}
\k{ey for plot window}
du  0   {upper dB-axis limit}
dl  -20   {lower dB-axis limit}
fl  0   {lower frequency limit. fl>=0}
fu  10   {upper frequency limit. fu>fl}
pts 21   {number of points, positive integer}
sr 1   {Smith-chart radius. sr>0}
S   11   {subscripts must be 1, 2, 3, or 4}
\p{arts window} {O = Ohms, D = degrees, U = micro,
|=parallel}
lumped 150O
tline 50O 90D
qline 50O 130D
xformer 1.73:1
atten 4dB
device fhx04
clines 60O 40O 90D
{Blank at Part h }
{Blank at Part i }
{Blank at Part j }
{Blank at Part k }
{Blank at Part l }
{Blank at Part m }
{Blank at Part n }
```

Figure 1. Original setup.puf.

The one critical point to make is the file extension ".PUF": Do not change this extension, for that is how the program finds your particular application set-up file. Another part of this set-up file contains "DEVICE FILE." This is the file that you load all the S parameters into for the particular device you plan to work with. This file must reflect accurately the S parameters for each device you plan to work with. They must cover the frequency range you call up in your setup.puf file or the program will halt. You will need one device file for each different device you have and a set-up file particular to each device/frequency that you plan to work with. All this information is necessary and must conform strictly to these rules.

The device file can be used by any set-up file calling for the same type device if the S parameters are called out for the frequency range in question in the device file. PUFF will pick out just the necessary frequency parameters you call out. For the NEC-04583, I called out S parameters in my device file from 0.1 GHz to 18 GHz. This requires a lot of typing, but it's worth it later. You can develop these files in a sort of library for later reference, making design very fast.

This file must be edited from the master .DEV file on the PUFF disk. DO NOT put any extra characters in the file; preserve it as a pure ASCII file. See Figure 3, my file for the NEC04583 S parameters from 0.1 GHz to 18 GHz. You can limit the frequency range by including only the frequency you need for calculations, but as I said, if other frequency use is contemplated it's best to have it all in the file. Once you get the hang of PUFF's format it will become quite easy to design a project. Most construction projects take only about a half hour, with most of the time used to modify the set-up file to suit your new requirements.

Let's get into some of the different parts of the PUFF screen. When you pull up the program you get four basic parts of the screen you can access. They are the Layout (F1), Plot (F2), Parts (F3), and the Board (F4). Each of these screen areas can be reached by typing the respective "F" control key on your keyboard. Typing "F10" at any time will bring up a small help function screen defining those commands particular to the portion of the screen you are currently residing in, such as "F4." To get the other help screens you must go to that screen, such as "F2," and re-type "F10" to get its help screen. Don't worry about all the commands in PUFF; just use "F10" for help, or post a lookup table from Figure 4.

Using the Program

Getting started in PUFF once your setup and device files are taken care of

```
\b{oard} {.puf file for PUFF, version 2.0}
d       0       {display: 0 VGA or PUFF chooses, 1 EGA, 2 CGA,
3 One-color}
o       0       {artwork output format:0 dot-matrix, 1
LaserJet, 2 HPGL file}
t       0       {type: 0 for microstrip, 1 for stripline, 2 for
Manhattan}
zd    50.000  Ohms {normalizing impedance. 0<zd}
fd    10.300 GHz   {design frequency. 0<fd}
er     2.500       {dielectric constant. er>0}
h      0.711 mm    {dielectric thickness. h>0}
s     33.000 mm    {circuit-board side length. s>0}
c      0.000 mm    {connector separation. c>=0}
r      0.200 mm    {circuit resolution, r>0, use Um for
micrometers}
a      0.000 mm    {artwork width correction.}
mt     0.010 mm    {metal thickness, use Um for micrometers.}
sr     0.000 Um    {metal surface roughness, use Um for
micrometers.}
lt     0.0E+0000   {dielectric loss tangent.}
cd     5.8E+0007   {conductivity of metal in mhos/meter.}
p      1.000       {photographic reduction ratio.
p<=203.2mm/s}
m      0.600       {mitering fraction.  0<=m<1}
\k{ey for plot window}
du  20    {upper dB-axis limit}
dl  -20    {lower dB-axis limit}
fl  9.0    {lower frequency limit. fl>=0}
fu  12    {upper frequency limit. fu>fl}
pts 21    {number of points, positive integer}
sr 1   {Smith-chart radius. sr>0}
S   21    {subscripts must be 1, 2, 3, or 4}
S   11
\p{arts window} {O = Ohms, D = degrees, U = micro,
|=parallel}
lumped 150O
tline 50O 28D
qline 50O 65D
tline 50O 40D
qline 50O 66D
qline 50O 90D
tline 50O 60D
device ne04583 3mm
tline 140O 90D
lumped 100O 2mm
tline 100O 50D
lumped 0O 1mm
tline 100O 50D
```

Figure 2. Modified setup.puf, renamed NE 4583U.puf.

```
{NEO4583 MES FET   Vds=3V, Ids=10mA}
  f          s11              s21              s12              s22
 0.1    0.999    -2.0    2.875  178.0    0.002   88.0    0.742    -1.0
 1.0    0.990   -18.0    2.794  162.4    0.016   78.0    0.729   -13.0
 2.0    0.970   -36.0    2.772  145.0    0.033   64.0    0.717   -27.0
 3.0    0.947   -54.0    2.716  128.0    0.046   49.0    0.706   -40.0
 4.0    0.915   -71.0    2.565  111.0    0.060   37.0    0.681   -53.0
 5.0    0.882   -87.0    2.534   95.0    0.069   26.0    0.669   -64.0
 6.0    0.854  -104.0    2.325   80.0    0.075   15.0    0.663   -76.0
 7.0    0.825  -120.0    2.100   65.0    0.080    5.0    0.650   -89.0
 8.0    0.790  -135.0    1.802   50.0    0.084   -6.0    0.643  -101.0
 9.0    0.775  -149.0    1.775   38.0    0.086  -12.0    0.643  -111.0
10.0    0.755  -162.0    1.650   26.0    0.088  -19.0    0.629  -122.0
11.0    0.774  -175.0    1.555   13.0    0.091  -26.0    0.631  -132.0
12.0    0.725   171.0    1.455   -3.0    0.094  -33.0    0.640  -142.0
13.0    0.705   159.0    1.350  -15.0    0.097  -37.0    0.642  -152.0
14.0    0.688   149.0    1.250  -26.0    0.100  -43.0    0.645  -163.0
15.0    0.680   142.0    1.200  -38.0    0.102  -45.0    0.654  -172.0
16.0    0.675   128.0    1.101  -50.0    0.105  -48.0    0.673  -178.0
17.0    0.652   117.0    1.051  -61.0    0.108  -50.0    0.687   170.0
18.0    0.630   107.0    1.012  -73.0    0.115  -54.0    0.696   160.0
```

Figure 3. NEC-04583 device file, 0.1GHz/18 GHz.

in your word processor is easy. When calling up the PUFF program, I suggest you start by typing "PUFF." This will bring up the default setup.puf file. Then go to the plot window "F2" and type a "Ctrl-R." This is the read file command and you can then specify the set-up file you want to use, like "NE4583U." The extension ".PUF" is not needed as PUFF keeps track of the extension. Once your new file is loaded, verify that you have a few parts in the "F3" parts area. At minimum, you need a "tline" and a device to get started. Type the information in; you can use the examples in Figure 1 or 2 for reference. Others can be added in the same format whenever you require them by accessing that portion of the screen: "F3," etc. Now go to the layout screen "F1" and you will see an "X" in the center of the screen if all is ok. If not, type a "Ctrt-E" to erase the circuit, then start over.

Usually we place the device at the center of the circuit. To place the device, look in the parts window and see which line you have the device specified on (let's say line d). Type that line letter, "d," and a device will appear at the center of the screen when you specify the direction you want the device to face. To face right, hit the right arrow key and the device will appear on the screen. Then move to the input of the device and hit the left arrow key. Now let's lay the first transmission line (strip line) going towards port 1, the input of the amplifier. Type the letter of your "tline" in the parts window (let's assume "b"), then type the letter "b" and the direction you want this strip line to go, and hit the left arrow key once.

This places the input strip line from the amplifier going towards the input connector of the board on the left. To connect the strip line to the connector, hit the number key "1." This will make an electrical connection to the input port between the strip line and the port 1. Use the right arrow key three times to go to the output of the amplifier. Now, to connect the output of the amplifier to port 2 for analysis (of the input network), hit the number "2" key. The circuit now goes from the input of the amplifier to the output and can be analyzed using the plot window.

Access the PLOT window by hitting the "F2" key. We can now set up the parameters for the plot analysis. All parts of the plot window, as well as the graph, can be changed to accommodate the type of plot you want to make.

Normally, we first start out making a plot of the input match of the network, the "tline" on line "b" of the parts file. The parameter we want here is "S11," input return loss or impedance matching at your desired frequency. To do this, go to the parts window "F3" and place a question mark in front of the electrical degree specified for the part you want to sweep. (Example: "b tline 50 ohms ?100 degrees.") Don't worry about the ohm symbol or the degrees symbol; they don't appear on my word processor, but they are taken care of in PUFF. To get a degrees symbol hit "Alt-D" and to get the ohms symbol hit "Alt-O"; the parallel sign is "Alt-P" and micro is "Alt-M." To get a big Smith chart using VGA monitors only, type "Alt-S." PUFF keeps symbols simple—if you forget type "F10" to bring up the help screen.

Now, to plot the proper value of electrical line length for part "b," go to plot window "F2," then arrow down to the test parameter and change it to "S11" from "S21." Then arrow down further to the graph and set top to, say, 40 and the bottom to −20 or so. Further arrow down and reset the bottom left edge to "0" and the right edge to "150." These are the values you are going to sweep between: plus 20 and minus 20 dB, and part length from zero to 150 electrical degrees. These values are not absolute. You can modify them to anything you desire. Verify that you have a small number of points in the plot window, say 20 or 50 points. If you have several hundred you will just have to wait until your computer gets done doing all the computations called for. If your computer is fast, go for the higher numbers. To start the plot sweep, type the letter "P" and sit back and watch.

What you want to record is the crossing point of the sweep on the "g=1" circle. To find out what this point is, move the marker with the "page up" or "page down" keys to enter the exact spot it crosses the upper part of the "g=1" circle. If it is not precise use more points of calculation and plot it again. When this value is noted, go back to the parts window "F3" and remove the "?" on the part and change its electrical degrees to that noted in the step just completed. Now establish another "tline" and set the value to any reasonable value, say, 50 degrees, and place the "?" in front of its part to sweep it. When this is done, go to the board window "F1" and position the marker on the left end of the "b" part. Erase the connection to the number 1 port by holding down the shift key and hit the number 1 key. After the connection has been erased type the new part "tline" letter, say, "c," and hit the down arrow. This should place a new matching "tline" on the left end of the "b" part. Reconnect port 1 by arrowing up one keystroke up-arrow, and type the number "1" to make the left circuit connection.

Now go back to the plot window "F2" and re-plot "S11" to determine the matching stub's proper value. If the "tline" strip is proper in length from the previous sweep, the new sweep should circle the "g=1" circle perfectly. Use decimal points to be exact to one or two places. You should obtain a good graph plot of high return loss "dip" in the chart at the frequency you desire to operate at. Use the page up and down keys to determine just where the crossing point is.

Some of the control characters are the photographic artwork, "Ctrl-A"; erase and start over, "Ctrl-E"; move to nearest node (can be very useful), "Ctrl-N"; re-plot, "Ctrt-P"; read file, "Ctrl-R"; and save file, "Ctrl-S," needless to say the most important of all commands to remember.

Well, so much for PUFF for this month. I hope you have as much fun as I have had. Next month I will cover some fine points on PUFF operation. I have a few NE04583 devices available, as well as a PC board using the NE04583 device, with gain of about 12 dB for one stage. The price of one device and PC board is $20 postpaid, or $10 each for either item postpaid. Save money and design your own with PUFF. As always, I will be glad to answer any questions covering this month's topic, as well as related subjects. 73 from Chuck WB6IGP. ■

```
F1   LAYOUT HELP
ARROW KEYS          DRAW PART
=                   GROUND
1 THRU 4            CONNECT PATH
a THRU r            SELECT PATH
CTRL-e              ERASE CKT
CTRL-n              GO TO NODE
SHIFT MOVE/ERASE

F2   PLOT HELP
ARROW KEYS          CURSOR
p,CTRL-p            PLOT
pgup<pgdn           MARKER
CTRL-s              SAVE
CTRL-a              ARTWORK
i,s                 IMPULSE STEP
TAB                 TOGGLE SMITH

F3    PARTS HELP
ARROW KEY           CURSOR
DEL,BACKSPACE,INS
ALT-o               OHMS SYMBOL
ALT-d               DEGREE SYMBOL
ALT-m               Mu SYMBOL
ALT-p               PARALLEL SYMBOL
CTRL-e              ERASE CKT
CTRL-r              READ FILE
TAB                 EXTRA PARTS
```

Figure 4. PUFF Command summary.

Number 25 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

More SAREX Activity Coming

The Shuttle Amateur Radio Experiment (SAREX) continues with more missions scheduled this year. Unlike the Russian *Mir* activity, U.S. shuttle operations use separate uplink and downlink frequencies. Current plans include 145.55 MHz as the primary downlink and 144.91, 144.95 and 144.97 MHz for uplinks.

Many shuttle crew members who are not yet hams are pursuing their licenses. The Johnson Space Center Amateur Radio Club and licensed astronauts have requested that SAREX equipment be carried on all high-inclination orbit missions. These flights provide more hams with the opportunity for earth-to-shuttle contacts. Starting with STS-50, a common callsign, W5RRR/S, will be used for shuttle missions to avoid confusion, especially for packet activity.

STS-50 is currently scheduled for launch on June 9th from Pad A at the Cape using vehicle 102, *Columbia*. Expected to last 13 days, this will be the longest orbiter flight to date. The inclination will be 28.5 degrees and the altitude 160 miles. The primary payload is USML-01, the U.S. Microgravity Laboratory. Richard "Dick" Richards is currently studying for his license and anticipates voice contacts on 2 meters, as with the STS-45 mission.

Late August is the anticipated liftoff of the *Endeavor* (vehicle 105) on a seven-day mission to 163 miles, with a 57-degree inclination orbit. This will be the second flight of the *Endeavor*. The primary payload is Science Lab "J" with 12 Get-Away-Special canisters (GAS-CAN's) in the payload bay. Jay Apt N5QWL is expected to operate both packet and voice.

Like earth-based stations, the shuttle crews run tracking programs to monitor anticipated coverage areas as they orbit the earth. The primary system includes a Grid laptop computer with a modified version of "Graf-Trak II" and "Silicon Ephemeris" by Silicon Solutions of Houston, Texas. Versions of the software have been available to amateurs and commercial interests for several years. Joe Bijou WB5CCJ has recently updated the shuttle software and Gil Carman WA5NOM of NASA has provided prelaunch testing of the package. Ground stations typically use a feature of "GrafTrak" to sequence through specific satellites as they pass over. The shuttle-based version operates from the spacecraft point of view to sequence through cities within range rather than orbiting objects. Other modifications to the software provide better and more detailed information on mutual visibility possibilities between the orbiter and *Mir*.

More SAREX missions are in the early planning stages for 1993. Some may use the simplified voice-only equipment while others may have enhanced operations for packet, slow-scan and additional modes. A good source of information for SAREX operations is the Johnson Space Center NASA BBS at (713) 483-2500. To use the BBS, call at 1200 bps, eight data bits, no parity and one stop bit. When prompted for a "number," enter 62511. Although the data system will respond to 2400 bps, the actual BBS will not.

AMSAT Nets

As a supplement to the March 1992 column, which gave a comprehensive list of satellite operation resources, here is information about the AMSAT nets.

Table 1 is a list of the current North American AMSAT HF nets, thanks to AMSAT Net Manager Wray Dudley W8GQW/7. For many enthusiasts, these nets provide a sole source of updated satellite schedules and general news concerning the amateur satellite program.

The Sunday 15 meter net on 21280 kHz can also be heard on an AMSAT-OSCAR-13 downlink of 145.955 MHz (USB) when the satellite is within range of Arizona (home of W8GQW/7). AMSAT also sponsors operations nets via A-O-13 on 145.950 MHz. The schedule of these nets changes to favor the orientation of the satellite. A current schedule is always included as one of the news items covered in the HF nets.

Participation in the A-O-13 operations nets is always good and sometimes quite surprising. On a recent net, Stan WA4NFY checked in using an experimental antenna built to specifications for the satellite-based array for Phase-3-D. The prototype patch antenna for 70cm had a better signal into A-O-13 than his 40-element crossed yagi. AMSAT officers and satellite designers are often available on these nets to answer questions and provide updates on future projects.

Russian Hamsats to End?

The recent political changes in the Soviet Union have not left amateur radio unscathed. The connection between ham activity and the government is not the same as in the U.S. Amateur radio is more tightly controlled and the satellite efforts are sometimes directly funded and administered by the government. Cutbacks in this funding could end some current and future projects. Cash flow difficulties at the RS control station RS3A in Moscow have already resulted in staff cuts.

For several years the RS program with its Mode A transponders (2 meters up and 10 meters down) has been considered the best entry-level satellite activity. The RS satellites have provided the starting point for many hamsat chasers. Other satellite builders around the world have gone on to VHF, UHF and microwave designs for new satellites.

RS-15 was originally scheduled for launch in April. Its future is now in question. This satellite was to have a 2000-kilometer circular orbit, much higher than the current RS hamsats. Other satellite programs beyond RS-15 (six in all) are also affected and may be canceled.

Efforts to solve the current financial difficulties with the RS program are underway, but the needed aid may be too late to maintain the program. Let's hope not. 73

Table 1. Active North-American AMSAT HF Nets

Net	Day	Time	Frequency (kHz)
AMSAT East Coast	Tuesday	9 p.m. Eastern	3840
AMSAT Mid-America	Tuesday	9 p.m. Central	3840
AMSAT West Coast	Tuesday	9 p.m. Pacific	3840
AMSAT International	Sunday	1900 UTC	14282
AMSAT International	Sunday	1900 UTC	21280
AMSAT International	Sunday	2300 UTC	18155

Number 26 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Over the past few years, I have described this column as dealing with all forms of digital communication, not just 5-level RTTY. This should be evident because of the frequent inclusion of AMTOR, packet, computers, and other more exotic digital modes in its content. Today we take a look at another digital mode, prompted by several letters from readers requesting programs to generate Morse code.

Morse code? Sure, why not. Morse is the ultimate digital mode, consisting of a single bit being turned on and off, albeit for varying lengths of time. Computers are ideally suited to the task of learning Morse, and such code generation is what many of you have asked for.

Interestingly, most of the requests have come in for a program for the Radio Shack Color Computer. This capable Motorola-6809-based computer was one of the first computers used by amateurs, and, interestingly enough, sported a multitasking multi-user operating system modeled on UNIX, OS9, long before Windows or OS/2 (notice the similarity?).

Anyway, I looked around on Delphi, and located two good programs. Published in the late *CLOAD* magazine, a magazine published on cassette for the Radio Shack Color Computer, some eleven years ago by a D. Rothstein, these two programs comprise an instruction module for Morse code. You can download them from the *73* BBS, under the file name CODE.ZIP.

For IBM PC clone users, the program listed here in the sidebar may be just what you're looking for. This is another older program (about nine years old), written by Elwood Downey WBØOEW. This BASICA program is straightforward enough to run in most

Continued on page 51

Morse Code Program for the IBM PC

```
10  ' Morse Code Practice Program. Elwood Downey, WBØOEW, August, 1983.
20  ' Written for the IBM PC in Microsoft Basica, V1.1, for PC-DOS V1.1.
30  ' This program may be freely used, traded or copied but the author's
40  ' name and this stipulation shall remain as comments and the program
50  ' shall never be sold for profit.
60  '
70  CLS
80  KEY OFF
90  '
100  ' select input source: either from a file, the keyboard or random.
101 PRINT:PRINT "   ALL entries are to be in LOWER case letters":PRINT
102 PRINT"    ENTER '!' TO START."
103 ZZZ$=INKEY$:IF ZZZ$="!" THEN 104 ELSE 103
104 CLS
110  INPUT "file name? (or 'random' or 'con:') ",F$
120  IF F$="random" THEN RANFILE=1 ELSE RANFILE=0
130  IF RANFILE=1 THEN RANDOMIZE VAL(RIGHT$(TIME$,2)): NCHRS=0:
      NGRPS=0
140  IF RANFILE=0 THEN OPEN F$ FOR INPUT AS #1
150  '
160  ' select speed
170  INPUT "wpm? ", WPM
180  '
190  ' initialize code strings
200  ' to add more characters, such as apostrophe, increase numcodes,
210  ' add code string and character at end of current lists and add case
220  ' to main loop, below.
230  NUMCODES = 41 ' . , / ? - plus 26 + 10
240  DIM CODES$(NUMCODES-1)
250  DIM CHARS$(NUMCODES-1)
260  FOR I=0 TO NUMCODES-1
270  READ CODES$(I)
280  NEXT
290 FOR I=0 TO NUMCODES-1
300  READ CHARS$(I)
310 NEXT
320 ' code strings. in one-to-one correspondence with characters, below.
330 DATA ".-", "-...", "-.-.", "-..", ".", "..-.", "—.", "...."
340 DATA "..", ". —", "-.-", ".-..", "—"
350 DATA "-.", " —", ".—.", "—.-", ".-.", "...", "-"
360 DATA "..-", "...-", ".--", "-..-", "-.--", "--.."
370 DATA "—, ".—", "..—", "...–", "....-", "....."
380 DATA "-....", "—...", "—..", "—."
390 DATA ".–.-", "–..–", "-..-.", "..–..", "-...-"
400 ' characters.
410 DATA "A", "B", "C", "D", "E", "F", "G", "H"
420 DATA "I", "J", "K", "L", "M"
430 DATA "N", "O", "P", "Q", "R", "S", "T"
440 DATA "U", "V", "W", "X", "Y", "Z"
450 DATA "0", "1", "2", "3", "4", "5"
460 DATA "6", "7", "8", "9"
470 DATA ".", ",", "/", "?", "-"
480 '
490 ' set up arrow keys to change speed and frequency.
500 PRINT
510 PRINT CHR$(24); " "; CHR$(25); " to raise or lower tone,    ";
520 PRINT CHR$(27); " "; CHR$(26); " for slower or faster code."
530 PRINT "Ctrl-Break to quit, F9 to pause."
540 PRINT
550 ON KEY(11) GOSUB 1040: KEY(11) ON
560 ON KEY(14) GOSUB 1050: KEY(14) ON
570 ON KEY(12) GOSUB 1090: KEY(12) ON
580 ON KEY(13) GOSUB 1080: KEY(13) ON
590 ON KEY(9) GOSUB 1330: KEY(9) ON
600 '
610 ' set defaults, init screen.
620 F = 600        ' initial tone frequency
630 SIL = 32767     ' special code for no tone
640 GOSUB 1120  ' calculate dit, dah and space lengths.
650 GOSUB 1180   ' display wpm and freq
660 '
670 ' define character type checking functions
680 DEF FNLOWER(C$) = "a"=C$ AND C$="z"
690 DEF FNUPPER(C$) = "A"=C$ AND C$="Z"
700 DEF FNDIGIT(C$) = "0"=C$ AND C$="9"
710 '
720 ' main loop. read (or generate) each character, sound it and print it.
730  IF RANFILE THEN GOSUB 1240: GOSUB 900: PRINT CHARS$(MORSE);:
      GOTO 870
740 C$ = INPUT$(1,#1)
750 IF " "=C$ OR C$=CHR$(13) THEN GOSUB 990: GOTO 860
760 IF "."=C$ THEN MORSE=36: GOTO 850 ' morse - codes$ array index
770 IF ","=C$ THEN MORSE=37: GOTO 850
780 IF "/"=C$ THEN MORSE=38: GOTO 850
790 IF "?"=C$ THEN MORSE=39: GOTO 850
800 IF "-"=C$ THEN MORSE=40: GOTO 850
810 IF FNLOWER(C$) THEN C$ = CHR$(ASC(C$)-32)
820 IF FNUPPER(C$) THEN MORSE=ASC(C$)-ASC("A"):  GOTO 850
830 IF FNDIGIT(C$) THEN MORSE=ASC(C$)-ASC("0")+26: GOTO 850
840 GOTO 870
850 GOSUB 900
860 PRINT C$;
870 GOTO 730
880 '
890 ' sound dit for each ".", dah for each "-" in string codes$(morse)
900 FOR I=1 TO LEN(CODES$(MORSE))
910  IF MID$(CODES$(MORSE),I,1) = "." THEN GOSUB 1000 ELSE GOSUB
      1010
920 NEXT
930 GOSUB 980
940 RETURN
950 '
960 ' produce elemental sounds, or silences.
970 SOUND SIL,DIT: RETURN   ' element space
980 SOUND SIL,ELE*2: RETURN   ' character space, allow for previous trailing
990 SOUND SIL,ELE*6: RETURN   ' word space, allow for trailing.
1000 SOUND F,DIT: GOSUB 970: RETURN      ' dit
1010 SOUND F,DAH: GOSUB 970: RETURN      ' dah
1020 '
1030 ' change frequency of tone
1040 F = F*1.104: GOSUB 1180: RETURN
1050 F = F/1.104: GOSUB 1180: RETURN
1060 '
1070 ' change speed; update element timings.
1080 WPM = WPM+1: GOSUB 1120: GOSUB 1180: RETURN
1090 WPM = WPM-1: GOSUB 1120: GOSUB 1180: RETURN
1100 '
1110 ' calculate element timings. units are clock ticks, which are at 18.2hz.
1120 IF WPM13 THEN CWPM=13 ELSE CWPM=WPM
1130 DIT = 21.84/CWPM: DAH = 3*DIT
```

(Program continued on page65)

Number 27 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

This month we are lucky to have a language lesson compliments of David Cowhig WA1LBP. David says that he is moving in May to Japan and will be gone for two years. He has requested a copy of the 73 universal reciprocal licensing form, so it appears that he wishes to remain active on the bands.

As I am writing this it is the first of March. Part of the correspondence that has arrived during the month of February is a press release from the International Telecommunication Union (ITU) written and released on 21 January, 1992. It speaks of the World Administrative Radio Conference (WARC 92). Its information is too old to make any sense in May, but one thing that caught my eye is that the conference ends on the 3rd of March, just two days away. I wonder what good things and bad things have fallen on the international ham community. Have we gained or lost in our quest for frequencies for our hobby? Oh, to have been a member of the team; but, like you, I will have to wait for more press releases to find out what happened.

I almost forgot: For the hams in the New England area of the United States, May 2nd is the date, and the location is the Fairgrounds at Deerfield, New Hampshire, for the 1992 Spring Edition of Hoss Traders. And don't forget, the gates open at 4 p.m. on Friday and overnight camping is acceptable. The proceeds go to the Shriner Burn Hospital in Boston. See you there, I hope!—Arnie, N1BAC

Roundup

Japan From the *JARL News:*

Radio Stations Exceed 7 Million

The Ministry of Posts and Telecommunications of Japan reported on November 21, 1991, that the present number of radio stations in Japan as of the end of September 1991 reached 7,027,215, which is an increase from the previous year.

Amateur radio stations numbered 1,154,142, which made it the third largest group, accounting for 16.4% of the stations. The largest group is the land mobile stations, with 3,039,034; and the second largest group is the personal radio stations, with 2,446,840.

The group of land mobile stations has recently been increasing at a remarkable rate, as high as 37 percent per year. And as a result, its share of all the stations has been growing annually.

All-Japan ARDF Competition

The '92 All-Japan ARDF Competition will be held in the Nan-Shin area of Nagano Prefecture on November 1st of this year.

Competitors will be selected from participants of the '91 All-Japan ARDF Competition and also from participants of local ARDF Competitions held on or after October 21, 1991.

Japanese Language Lesson: More than one million hams call Japan their QTH. As Cycle 22 solar activity continues to increase *[Or decrease, as the case may be.—Arnie]*, we'll have more and more opportunities to work JAs. Japanese hams study books such as *English for Ham OSO* by JA1ANG and *Conversational American English for Ham Radio* by Roy Waite W9PQN in order to improve their English. We U.S. hams, however, have no book to teach us the Japanese we need to get through a simple QSO with a Japanese amateur in Japanese. Japanese hams rarely enjoy the luxury of working DX (like us!) in their own language. Not quite fair, is it? We can't expect people around the world to speak to us in English forever.

> ***"We can't expect people around the world to speak to us in English forever."***

Here I'll present a few Japanese phrases you can try on your next JA contact. They should get a big kick out of it. The JA stations I contact get a bit of a shock when I come back to them in Japanese!

First, a few comments on Japanese pronunciation. Although the Japanese writing system, which uses Chinese characters and two 51-symbol syllabaries, and the grammar are difficult, Japanese pronunciation is very easy. Place equal stress on each syllable. Not Toyota but To-yo-ta. Not Yaesu but Ya-e-su. I mark long vowel sounds by doubling the vowel. My transcription is essentially the Hepburn system, a system used internationally for writing Japanese using the Roman alphabet. My main departure from the Hepburn system is adding dashes between syllables. Where the Hepburn spelling might be misleading, I have placed a close English equivalent in brackets. Remember, equal stress on each syllable is the key.

O-hi-o go-zai-ma-su. Good morning [Pronounce o-hi-o like the state of Ohio. It's morning in Japan when we work them in the evening.]

Wa-ta-ku-shi no QTH wa [ba-ji-ni-a shu] de-su. My QTH is the [state of Virginia].

Re[ley]-por-to wa five-nine. Your report is 59 [I often hear Japanese hams giving reports to each other (using English!!) in this way so you do the same.]

Wa-ta-ku-shi no QTH wa [a-mer-ri-ka no shu-to Washington DC] ka-ra ju-ni ki-ro-mee[may]-to-ru ku-rai no to-ko-ro de-su. My QTH is about 12 kilometers from [the U.S. capital, Washington DC., so they won't confuse DC with Washington state].

Wa-ta-ku-shi wa Mt. Vernon a-ma-chya mu-sen ku-ra-bu no mem-ba de-su. I am a member of the Mt. Vernon ARC.

Na-mae wa David de-su. My name is David. [If the Japanese operator gives his name as Tomo, refer to him as Tomo-san. Do not put -san after your own name.]

[To-mo]-san no ei-go wa tae-hen hoo-zu de-su ne. Your [Tomo's] English is very good.

Ni-hon-go de nan te i-ma-su-ka. How do you say that in Japanese?

If you have a solid contact, you might ask the Japanese operator how to say some phrases in Japanese. You can thank him by saying:

[To-mo]-san wa tai-hen ii ni-hon-go no sen-sei de-su. You [Tomo] are a very good Japanese teacher.

To-te-mo ta-no-shi QSO o doo-mo a-ri-ga-to-go-zai-ma-shi-ta. Thank you for a very enjoyable QSO.

Ma-ta doo-zo yo-ro-shi-ku o ne-gai shi-ma-su. Please give me a call another time.

Try some of these phrases on your next contact with JA. It should get you out of the carbon copy QSO rut. Give a JA operator a good laugh and improve your Japanese at the same time!

If you would like to learn to speak simple conversational Japanese fairly quickly, consider *Japanese for Beginners*, published by Gakken. You can purchase it with two cassette tapes. This book takes you through the essentials of Japanese grammar and builds up to a 1,200 work vocabulary in 180 (small) pages. Not a large vocabulary, but considerably larger than the English vocabulary of many of the DX stations you are working now. Have fun!

73 de David Cowhig, WA1LBP

[What you have seen is the first in a series from David to "Ye Old Rf Output," newsletter of the Mt. Vernon ARC. If you have any comments for David you had better hurry because he is leaving in May for two years in Japan. His address is: 6317 May Blvd., Alexandria VA 22310. Or send him a packet message to WA1LBP @ N4QQ.MD.USA.—Arnie]

Scotland *Information from "Paddy" McGill GM3MTH*: The Scottish Tourist Board (Radio Amateur) Expedition Group, STB(RA)EG, would like to announce its awards program for 1992. The purpose of this group is: (a) To set up worldwide Communications Stations in Scotland that are Unique, Scenic, Cultural, Historic or in any other way relating to Scotland; (b) To make the Public more aware of the Hobby of Amateur Radio through a Public Relations display at each event. All events are open to the Public.

The THISTLE AWARD and The SUPREME TARTAN BANNER AWARD are issued by the Group on a continuous basis. Both awards are in colour. Claims for ALL Scottish Tourist Board Awards should be sent to: Awards Manager (Robbie GM4UQG), PO Box 59, Hamilton, Scotland ML3 6QB.

The events for this year are: (1) Scottish Activity Weekend—3rd weekend in April each year; (2) Castles on the Air; (3) Eight Nations National Trust Event; and (4) International St. Andrews Day. The planned frequencies are (±): C.W. 3510, 7010, 10140, 14010, 21010, 24905, 28010 MHz; SSB 3765, 7065, 14140 & 14240, 18130, 21250, 24950, 28400 to 28600 MHz. The times of the events are normally Saturdays, 0800 to 2200 UTC, and Sundays, 0900 to approximately 1500 UTC. Times are subject to change.

If you wish a list of events/information package, it is available from: John "Paddy" McGill GM4MTH, 9, Ramsay Pl., Coatbridge, Lanarkshire, Scotland, ML5 5RE. Please send two second class stamps or equivalent for return postage. Tel: (0236) 440495; FAX: 0236434194; International: +44236434194.

The following is a quick list of events through May: April 11th, GB2SMC, Scottish Museum of Communication, Grand Opening in Bo'ness; April 18/19, GB2STB, 1st Annual Scottish Activity Weekend, 12 Scottish Regional Stations, Clubs, and individual stations, Certificate & Trophies; May 16/17, GB400CA, Crathes Castle 400th Anniversary, 2nd Annual Castles on the Air, nine castles in UK and Ireland, Certificate. *[I will put the Certificate and Trophy Information on the 73 BBS in the "73 International" area. I remember that several years ago the STB(RA)EG operated from some of the distilleries. Why not this year? I guess I will have to write Paddy and find out.—Arnie]*

U.S.A. *From the International Mission Radio Association (IRMA) Newsletter*: IRMA has been developed to provide transfer of traffic for missioners of all denominations and for other volunteer services. Their traffic handling net operates Monday through Saturday, from 1900–2000 GMT (Daylight Saving Time 1800–1900 GMT) on 14.280 MHz. If you would like to receive more information, join IRMA, or receive their newsletter, contact: IRMA Newsletter Editor, Rev. Michael Mullen, C.M. WA2KUX, St. John's University, Jamaica, NY, USA 11439.

Number 28 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

Deadline for the June classifieds is April 13, 1992.

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HISTORICAL DOCUMENTS: ARRL Handbooks, 1st 1926, 6th, 8th, 9th, 10th, 11th, 20th, 26th, 29th, 32nd: 1st edition 200 Meters Down: large number of QST in long broken sequences from 1921 to 1954: some R/9, Radio and CQ: 1936 Radio Antenna Handbook: Design Modern Radio Receiving Sets 1922 Vol 1, 2: 100 Radio Hookups Muhleman 1924: Radio Hookups Sleeper, 5, 1922. $500.00 plus packing shipping: John Brolley, 1225 Los Pueblos, Los Alamos NM 87544. BNB904

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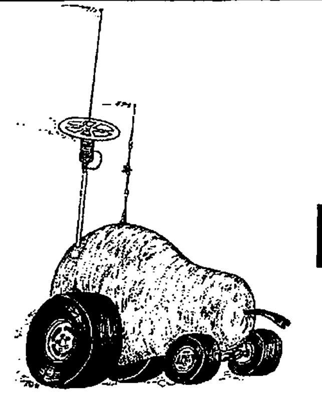

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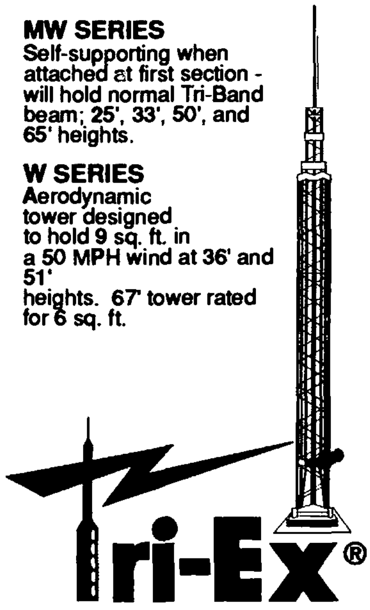

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RANDOM OUTPUT

David Cassidy N1GPH

No Code—One Year Later

As I write this, we have just passed the first anniversary of the codeless Technician class license. We've had a full year to take a good, hard look at this controversial (to some) rule change. From everything I've heard and seen, I think we can declare the no-code license an overwhelming success. No matter how hard a small but vocal minority tries to put it down (still!), the dropping of the code requirement for VHF and above licenses has had nothing but positive influence on amateur radio.

And yet, that small minority of fuddy-duddies still can't get it through their crusty craniums that the future of amateur radio has nothing to do with this particularly outdated mode of communications.

Just last week, I got into yet another drawn-out conversation with a middle-aged ham who was predicting the downfall of amateur radio (not that all hams who oppose the no-code license are middle-aged—some of them are really old). He used all of those "intelligent" arguments that we've all heard a thousand times: The bands will be full of unqualified riff-raff (unlike the qualified riff-raff we now find ourselves stocked with). The ham bands will be full of all them good-buddy CBers (without exception, every former CBer I've ever met—on the air or in person—has been a credit to this hobby). It's dangerous to let unqualified (there's that word again) people muck around with potentially dangerous electronic equipment (I've yet to hear a good answer when I ask how a knowledge of Morse code makes someone qualified to work on electronic circuits). Two meters will be filled to the brim with these codeless Techs (I sure wish that were true, but alas, 2 meters seems to be just as barren of activity in most of the country as before). I had to learn the code, so everyone else should, too (this comment doesn't even deserve a reply). Morse code is an amateur radio tradition that should be maintained (sure, just like spark gaps, tubes and 2 meter AM).

Not content at letting the technological advances of the last 30 years shoot by them, these curmudgeons have actually pestered the FCC with numerous requests to either amend or reverse the no-code ruling. If they couldn't get the no-code Techs thrown out, they at least want to saddle them with a distinctive callsign. I imagine that this is so they can identify and avoid talking with no-code Techs (no great loss for the Techs). Gee, I wonder what the opinion of the FCC was of having to spend the time and resources to deal with these complaints and petitions? I wonder if the actions of these crybabies did anything to improve the FCC's already low opinion of amateur radio operators?

Allow me to share with you a few of my observations of the effect of the codeless Technician license. I have met hundreds of these newly licensed hams over the past year. I've talked to them on the air. I've met them face-to-face at hamfests. I've received their letters and phone calls.

1. I've noticed that there are a lot of younger faces entering amateur radio via the codeless Technician class license.

2. I've noticed a lot more women with newly acquired callsigns.

3. I've seen auditoriums from Florida to California packed with youngsters at Youth Forums.

4. Every new Technician I've met—every single one—has told me that they are currently studying the code so they can get on HF.

5. I've received letters from amateur radio clubs across the country who can't get their license classes going fast and frequently enough to satisfy the demand—and that includes code classes and upgrade classes.

6. I've seen attendance records made at almost every hamfest I've attended this year.

7. I've seen the amateur radio business community increase sales during the worst recession since the 1930s.

So, would somebody kindly explain to me what the problem is?

One other benefit I've noticed is that there is a lot more "elmering" going on these days. I hear experienced hams kindly counseling a frightened newcomer on proper repeater procedures. I've heard people offering their help to newcomers on every repeater I've checked into. Help with antennas... loans and repair of old gear...rules clarification...invitations to club meetings. All over the country, I've heard experienced hams reach out to these newcomers with understanding and patience. They have obviously found out something that has always been true—you get an incredible amount of personal satisfaction from helping newcomers.

To be sure, I've also heard newcomers chased off of repeaters. I've received letters from clubs that voted to keep out codeless Techs (gee, I wish I could hang out with those guys). I've seen hams who wouldn't know a transistor from a tuna sandwich telling electrical engineers and computer programmers that they aren't qualified to be hams because they didn't pass a code test. I've even seen anti-Technician writings in amateur publications (though none that are important enough to make any difference). Thankfully, these types of episodes have been few.

If there has been a negative side to the codeless Technician license, I've yet to see it. Thousands of enthusiastic and motivated newcomers are good for any hobby—especially a hobby that is currently searching for new justifications for its existence.

As for those few who continue to complain about the passing of Morse code—don't fret. It's only a matter of time before we are picking over their stations at a local flea market and see them listed as Silent Keys. 73

Number 30 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson AZ 85541

Conditions this month are expected to be fairly quiet on the HF bands... with little magnetic field disturbance, reflected by generally low "A" indexes and solar flux indexes. The 10 cm flux is likely to be below the March and April values, and DX conditions will therefore not be quite as good as during the spring months.

You can expect generally Good conditions, however, with considerable DX activity on 10 and 12 meters, peaking in the afternoon, and usually favoring transequatorial paths. Short skip will also abound between 500 and 1,000 miles or so. On 15, 17, and 20 meters, worldwide DX should be available most days between dawn and sunset, again peaking in the afternoon. Short skip out to about 2,000 miles will prevail on most days.

On 30 and 40 meter bands, DX should be good during hours of darkness until after dawn. Short skip to 1,000 miles during the day, and to 2,000 miles at night should be workable on most days and nights.

On 80 meters, DX to various parts of the world should be workable on some days of the month—particularly during nighttime and early morning hours—when the bands are quiet and noise levels are low. Daytime short skip will also be available, but late spring and early summer conditions on 80 meters during the day are not generally considered to be particularly favorable—often due to thunderstorm activity and high levels of static.

The sunspot cycle continues its inevitable slow decline this year, and soon we shall begin to notice dropout of the higher HF bands and lack of quality "solid" signals on many days of the month. WWV continues to be your best source of current information each day, so check at 18 minutes after any hour for the readings of "A"/"B" magnetic field indexes and Solar Flux Index. Also, keep a sharp lookout for SID (Sudden Ionospheric Disturbance) reports this month via WWV.

VHF activity on 6 meters and above can be very good this month, so check the 6 and 2 meter bands frequently for "tropo" and sporadic E-layer activity.

Consult the accompanying charts for a preview of likely Good and Fair conditions on the HF bands. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	10/15	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	40	40/80	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	20	20	20	—	20(1)	20(1)	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20(1)	—	—	15(1)	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
ENGLAND	40(1)	40/80(1)	40(1)	—	—	—	—	—	15*	15*	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15(1)	15/20(1)	—	—	—	—	—	15/20(1)	15(1)	—	—	—
JAPAN	10/15	15	20	20	20	—	20(1)	20(1)	—	—	—	10/15
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
PHILIPPINES	10/15(1)	—	20(1)	20(1)	—	—	—	—	10/15(1)	10/15(1)	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	10/20	20
U.S.S.R.	—	—	—	—	—	—	—	15(1)	15(1)	15(1)	20	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/40	20/40	20/40(2)	—(2)	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15(1)	20	—	—	—	—	—	15/20(1)	15(1)	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/40	20/40	20/40(2)	(2)	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/40	20/40	20/40(2)	(2)	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20(1)	—	—	20(1)	20(1)	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

* Try next higher band on "G" days (1) Possible opening on this band on "G" days. (2) Try 80m.
Note A: Use values of 10/15 for 12m; 20 for 17m; 40 for 30m. Note B: This chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

MAY 1992

SUN	MON	TUE	WED	THU	FRI	SAT
					1 F-G	2 G
3 G	4 G	5 G	6 G	7 G-F	8 F	9 F-G
10 G	11 G-F	12 F	13 F-G	14 G-F	15 F	16 F-G
17 G	18 G	19 G	20 G	21 G	22 G	23 G
24 G / 31 F-P	25 G	26 G	27 G	28 G-F	29 F	30 F

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JUNE 1992
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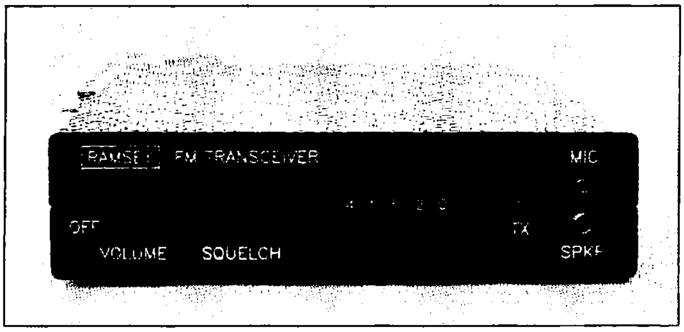
TABLE OF CONTENTS



8,000 channels... see page 10.

FEATURES

REVIEWS

Cover: Now that the good weather is here, it's time to think about putting up that tower you've always wanted. See page 42.

Cover photo by David Cassidy N1GPH.

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Good News—Bad News

The news, good and bad, is that Wayne Green again owns *73 Magazine*. Well, you probably weren't even aware that I haven't owned it lor almost 10 years, so never mind.

When I sold my seven computer magazines and other stuff In 1983 I also had to sell *73* at the same time because I was left with no publishing company with which to publish it. So IDG took over the publication while I started from scratch to build a new publishing company.

There was a big sigh of relief by IDG when Wayne and his long, controversial editorials were finally out of the magazine . . . now circulation would grow and advertising sales would zoom. Instead, despite every effort, the circulation dropped off disastrously and ad sales dwindled.

Just as the death rattles were beginning to be heard, IDG gave up and talked me into publishing it again . . . on contract. They retained ownership and a share of the profits. Profits? From a magazine that I'd managed to lose money on for over 20 years? Har-de-har.

Like all entrepreneurs, my interest was never in making money, so whenever there seemed like a danger of a profit I'd start a new project and take care of the problem. *73* always lost a little money, but never enough to put it out of business . . . and the other projects always made enough to keep *73* going. Nothing has changed. I publish *73* because I think it's needed . . . and ham radio is still my #1 hobby, even after over 50 years.

So here I am 32 years after starting the magazine, again the owner, and still losing a little money with it. IDG wanted to buy my *CD Review* magazine, so as part of the deal I got *73* back. I have no idea why they wanted to buy my music magazine . . . I'm not even convinced they'll be able to run it successfully. But after eight years it was mature and I much prefer to do new things . . . like *Radio Fun*. I enjoy starting new publications.

With the sale of *CD Review* I'm down to just a few publications . . . *73, Radio Fun, Secret Guide, Music Retailing, IMPS Journal, NIAC* newsletter, a recording studio, a music distribution company, a mail order music company, and live record companies. Time hangs heavy on my idle hands.

Of course I do have several new publications being gestated. My idle hands are the devil's playground. And I've been generating a storm of plans for bringing New Hampshire into the 21st century ahead of the other states . . . with a complete revamping of our educational system among other things. Some of our 73-BBS customers have dumped my 300-page book on the subject.

The change of ownership won't change *73*. It's being run almost totally by Bill WB8ELK and Dave N1GPH, with me writing editorials now and then.

Well, I thought you might like to know.

Homosexual Hams

There are probably some red-faced hams out there who were furious with me for running ads last year for a homosexual ham club. They were firmly convinced that homosexuality is catching—like communism—and that therefore youngsters shouldn't be exposed to it. I explained in my editorial that it's genetic, so not to worry that their impressionable children would be lured into homosexual liasons once they knew there was a homo ham club.

I became aware of this as a result of my professional psychological work with several homosexual patients. It is not something which is curable—at least not yet. It's always possible that scientists may come up with some genetic engineering which could make everyone hetero.

A number of news magazines have reported on recent scientific research which shows that one's sexuality is born, not bred. This confirms the work I did when I regressed homosexual patients and found they were aware of their feelings even when they were one and two years old.

Frankly, I was disappointed to find that homosexuality was genetic. I'd hoped to find It a nurture problem, in which case I might be able to help people with this "problem" through therapy.

Well, I can't do much about hams who hate or fear homosexuals because of stupidity, but perhaps I can help combat ignorance on the subject and make things a little more comfortable for everyone.

Of course I'm probably off on the wrong foot when I assume that ham homo-phobes read newsmagazines, so perhaps a note in *73* Is appropriate. I'm used to finding a lot of Archie Bunker in older hams, so while I may be dismayed by their reactions, I'm not surprised.

If one takes the long view of things, the whole world is gradually intermarrying, so we'll all end up a sort of light brown, with perhaps a slightly yellowish tinge. It'll take a while, but it's Inevitable. In the meanwhile we'll all continue to respond to our own inferiority feelings by dumping on others and putting them down. And that's what it's all about. The more the put-downs and name-calling, the stronger are the inferiority feelings being compensated for.

In the meanwhile we'll have our ethnic, religious, and political groups busy killing each other. While I'm sorry to see this happening, I also recognize that it's all part of a basic plan for all life on earth—the survival of the fittest. All life has fundamental built-in programmed instructions to stay alive and recreate one's self.

Nature (God, if you like) is merciless, doing away with failed life forms by the tens of thousands. Mankind, stirred by impassioned environmentalists, often does its best to upset nature and fight God's will, so to speak.

But you know, even with the millions Hitler wiped out, and the tens of millions Stalin and Mao killed, mankind seems to be carrying on. We have no population shortages in sight. Science has moved ahead without missing a step.

Hmmm, I'm waxing philosophical again. Wax and Wayne.

Subliminal Messages

If you read many magazines or newspapers you've seen ads for subliminal tapes which will help you stop smoking, lose weight, be happier and so on. Hmm, one wonders, how many of those ham broadcasters are subliming us?

Can this explain the fierce devotion to the ARRL by thousands of otherwise seemingly unintelligent hams? Have they been subliminally brainwashed while listening to ARRL bulletins? Glenn what's his name in Maine claims thousands of listeners to his endlessly self-promoting broadcasts. Can this explain that weird behavior?

I thought I'd put in that poke at the League to titillate my duuuh readers who are ever-alert to my trashing the ARRL. I enjoy making fun of the League mainly because so many readers take it seriously and get livid. There goes Wayne putting down the League again! You bet . . . and chuckling as I twist the knife.

But isn't it mean for me to tweak hams who've been brainwashed by subliminal messages during the ARRL broadcasts . . . and by all those subliminals in *QST*? After all, it isn't really their fault . . . they didn't mean to get hooked. Isn't it like blaming drug users for their habit?

The obvious answer is yes, and I should be ashamed of myself for so mercilessly taking advantage of subliminally blinded hams . . . hams whose very minds have been taken over by those arch fiends in Newington and their unholy cabal of directors. I ought to recognize that no carrier of the light . . . no whisperer of truths . . . can prevail against their ruthless mind control technology.

You've probably read that people under a hypnotist's control can't be made to do things they wouldn't normally do . . . like kill people or have sex with the hypnotist. And that's what hypnotists want you to believe, though there's not a word of truth in it. Should it count as rape when an evil hypnotist forces a lovely young girl to have sex with him by telling and convincing her how much she wants to?

We're all familiar with how the subconscious works. We all know people who are addicted to cigarettes, alcohol or other drugs and won't consciously admit, even to themselves, that they're addicts. The subconscious works sneakily, bul never forget that it's in control, not the conscious mind. It's the force behind the things we do that we don't know why we do. It's the force behind beliefs, no matter how weird. It's the force that makes us angry when a subconscious belief is disturbed. It's the source ot all our phobias . . . our fears for which we have no explanation.

No wonder cults . . . enormously powerful cults . . . are based on control of the subconscious. No wonder so many big companies try to reach this key power center with their advertising.

No, you'll never consciously detect these seductive, mind-controlling messages as they are subliminally taking over your subconscious as you listen to W1AW or K1MAN . . . or as you merely glance at the innocent-looking pages of *QST*. We are so used to the messages from Coca Cola, MacDonalds, and other masters of seduction that we consciously feel nothing . . . but perhaps a thirst or a hunger.

So, knowing that tens of thousands of hams have had their minds totally under League control for years, I gently rock the boat and smile as I watch the angry reaction. But which is the real devil? Is it the mind-controlling organization or the tweaker?

Is this a new phenomenon? No, not at all. I first became aware of this secret plot when I read the Doyle Letters . . . letters from an ARRL director to several fellow directors which discussed this and some other plots. Doyle revealed that the president of the ARRL was In the pay of Hallicrafters to see that their equipment always got more space in *QST* than any other, and that the equipment reviews

Continued on page 76

QRX . . .

Introducing Wayne Green, Inc.

For the past several years, readers have become accustomed to the familiar notation of "A WGE Publication" on the covers of *73 Amateur Radio Today*. As we went to press last month, a deal was reached between Wayne Green and WGE parent company International Data Group whereby full ownership of WGE, including certain properties and assets, was sold to IDG for an undisclosed sum, effectively dissolving WGE.

Part of the deal is that Wayne Green, under the new corporate name of Wayne Green, Inc., has regained full and complete ownership of the rights to *73 Amateur Radio Today*.

While all of this corporate shuffling may be of interest to Wall Street types, the only immediate change for readers, advertisers and distributors is that the editorial and advertising offices have moved, and all phone numbers (except the 800 subscription number, which rings at a subscription company in Colorado) have been changed.

Here's all of the new information:
73 Amateur Radio Today
70 Route 202 North
Peterborough NH 03458

Editorial/Advertising Offices: (603) 924–0058

FAX: (603) 924-9327
Ad Sales: (800) 274-7373
73 BBS: (603) 924-9343

May Cover Contest Winner

When we asked readers to identify what was wrong with our cover photo last month, we had no idea of the volume of mail we would receive. Thousands of letters, postcards and faxes arrived at our offices, most with the correct answer and a few creative incorrect guesses.

One reader thought the mistake was the "A WGI Publication," printed in the upper right-hand corner (see above story). Another reader assumed that the woman was communicating on a marine HT with the boat in the background—the mistake being the violation of regulations that prohibit this exchange.

Many readers thought we made up a prop HT (an ICOM IC-24AT) with the antenna on the wrong side. They were getting warm.

The overwhelming majority of you got the right answer: The photograph was reversed. In order to get the shot we wanted on location and still set up the cover with room on the left for text, it was necessary to shoot the photograph with the woman on the left side, then reverse the photograph so that she would end up on the right side of the page.

Although the HT gave it away, one nautical ham noticed that the running lights on the boat were reversed. One reader said it was "obvious" that we had used two negatives—that the photo of the water and the photo of the woman were two different shots (they were not).

The winner of the one-year subscription is John Huber N8FYL of Troy, Michigan. His was the very first postcard received with the correct answer.

Judging from the reader response, this was a fun little contest. We'll look for an opportunity to do it again in the future, but next time we won't make it so easy.

Indecent Broadcasts

The United States Supreme Court has refused to hear an appeal of a decision of a United States Court of Appeals which held unconstitutional an around-the-clock ban on indecent broadcasts. The high court let stand a May 17, 1991, decision of the U.S. Court of Appeals for the District of Columbia Circuit which held that broadcast material which is indecent but not obscene is protected by the First Amendment, and any restrictions on such broadcasts must be narrowly drawn. The Appeals Court instructed the FCC to determine the times at which indecent materials may be broadcast. In doing so, the FCC must determine the times when there is a reasonable risk that children, who may properly be protected by the government from such broadcasts, are in the broadcast audience.

The decision of a three-judge appeals court panel unanimously concluded that a 24-hour-per-day FCC ban on indecent broadcasts, even though mandated by Congress, was unconstitutional. The Court of Appeals had earlier determined that the FCC must carve out a safe harbor for such broadcasts, but recognized that even constitutionally protected speech can have a strong negative impact on children. Thus, limitations on indecent broadcasts can be imposed, if carefully and narrowly crafted.

The FCC has continued to impose fines on broadcast stations for indecent broadcasts made during the times of day in which children are clearly in the audience. The implications of the court rulings for amateur radio are unclear at present, though the FCC has previously stated that its policies regarding broadcast indecency are equally applicable to amateur radio, noting similarities between the two services. FCC chairman Alfred E. Sikes has recently stated that it is the FCC's intention to enforce its rules concerning indecent broadcasts to the extent permitted by law. ARRL President George S. Wilson III W4OYI was scheduled to be in Washington on March 13 to discuss the matter with FCC Commissioners and Bureau Chiefs, and to urge increased enforcement efforts to resolve what many amateurs believe is a serious problem. *TNX Mike Shy, April 1992.*

Tapes for the Visually Handicapped

Master Publishing, Inc., has granted permission to transfer amateur radio license preparation material authored by Gordon West WB6NOA to audio tapes and/or braille for the visually handicapped. Contact the following agencies for availability:

Volunteer Services for the Visually Handicapped, Inc., 814 W. Wisconsin Ave., Milwaukee WI 53233-2385; (414) 278-3039.

Braille Institute, 741 N. Vermont Ave., Los Angeles CA 90029-3594; (213) 663-1111.

Utah State Library Division, Blind and Physically Handicapped Section, (2150 S. 300 W. #16, Salt Lake UT 85115; (801) 466-5888.

Recording for the Blind, 20 Roszel Road, Princeton NJ 08540; (609) 452-0606.

TNX W5YI Report, Vol. 14, Issue #7, April 1, 1992.

SAREX

W5RRR/S will be the shuttle's call for all future SAREX missions. Two SAREX missions are scheduled to fly this summer: the STS-50 US Microgravity Laboratory and the STS-47 Spacelab Japan mission.

The STS-50 *Columbia* mission will feature the first extended duration orbiter flight, for a record 13 days in space. The mission will carry the United States Microgravity Laboratory (USML) on its first flight. Commander Dick Richards and mission specialist Ellen Baker expressed an interest in SAREX and decided to become hams. They have passed their tests and should get their calls before the launch. On this mission Dick will operate the SAREX-D configuration which flew with the STS-37 crew, including voice, packet, two-way slow-scan, and fast-scan receive modes. To save space the crew will not be using the combination VCR/monitor used on the STS-37 mission. The shuttle's monitors will be used to view video transmission from the ground and video will be recorded on the 8mm camcorder. More importantly, the current SAREX antenna would not work well on STS-50 due to the shuttle's attitude. The USML mission requires a gravity gradient attitude, with the shuttle's tail pointed towards the earth. The dual-band antenna (2m voice/packet/SSTV, 70cm ATV) has been repackaged into a rectangular antenna which fits into an overhead window, similar to the antenna used on the Spacelab 1 and Spacelab 2 missions.

The STS-47 *Endeavor* mission will feature Jay Apt N5QWL, who flew aboard the STS-37 mission, making him the first ham to operate SAREX aboard more than one mission. The mission will include the SAREX-C configuration with packet and voice operations, similar to Ron Parise WA4SIR's STS-35 ASTRO-1 experiments. Many educational contacts are planned, including several with Japanese students. Proposals for preplanned educational contacts should be sent to the ARRL before June 1st. *TNX Earth News.*

Wanted: Technical Editor

***73 Amateur Radio Today* and *Radio Fun* are looking for a technical editor with a ham license, good knowledge of electronics, and good writing and editing skills.** Send cover letters and resumes (no phone calls, please) to: David Cassidy, Associate Publisher, *73 Amateur Radio Today*, 70 Route 202 North, Peterborough NH 03458.

TNX...

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine,* Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

LETTERS

Number 3 on your Feedback

From the Hamshack

Dave KD8VI, Lakewood OH I just had to dash off a response to reader Bill Ewald's letter appearing in the February 1992 issue of *73*. It gave me a good chuckle. I couldn't think of anything more out of phase with how I regard your editorials. Hell, I'd gladly pay the subscription price for your editorials alone. The rest of the magazine is a bonus.

I do wish, however, that you'd somehow find the time to write some in-depth historical articles which would detail things such as the "incentive licensing debacle" and some of the other noteworthy topics you sometimes allude to in your editorials. I'd like to hear more on L. Ron Hubbard, and on why the ARRL is our sole national representative and how it got to be that way. I'll bet your perspective would bring the light of truth to these subjects like no one else's.

Keep up the great motivational writing, Wayne. You can't possibly realize how your monthly manifestoes have helped me. That callsign after my name is but the smallest part of the effect they've had.

Marion D. Kitchens K4GOK, Oakton VA Just a note to let you know I enjoy your "Never Say Die" editorials. They are thought-provoking and informative, and at times they are funny too. I enjoyed your reply to a criticism, when you said the editorials were aimed at those with at least two-digit IQs!

While I don't agree with 100% of your ideas (after all, no one is perfect!), I do agree with about 99% of your thoughts. This country needs more people like you with open, energized minds, people who are willing to get up off their duffs and simply do a good day's work.

Gene Roban, Minneapolis MN Wayne, please tolerate my bending your ear for a couple of minutes while I talk about my son, Philip NOETX. When he was 10 he bought a Grundig Mickey-Boy portable for $2 at a yard sale. Two years later he was NOETX. He is now 22, is at the highest amateur license level, and is a junior at the University of Minnesota, where he is enrolled in the Institute of Technology Honors Program. In June 1993 he will receive two degrees, one in physics and one in chemistry. He has a 3.6 GPA.

Despite these achievements, he has never been recognized as a scholar by anyone other than his teachers and his relatives. He has never received one cent in scholarship money. I think it's because we as a society have redefined the word "scholarship" to mean "Let's give the kid some money—he's poor." That is where 95% of all scholarship money goes today, regardless of the student's academic achievements.

My wife and I work very hard to pay for his education because we don't want him to be up to his ass in government loans on graduation day. There are, without doubt, other kids as dedicated as Phil who drop out because of the financial burden.

Let's work hard to put the scholar back into scholarship! Let's find out who the go-getters are and reward them the way we reward the kids who can swish a 25-foot jump shot or throw a football 60 yards. I'd like to see the high schools give a letter in math or science fair participation, or ham radio. These kids need recognition and prestige as much as anyone else. We should think about what they will give back to us.

Lawrence K. Herbert NL7U, Deltona FL I enjoy reading *73 Magazine* and hope that you will keep up the good work. In this section of your magazine I usually read about electronics dealers who have been exceptionally good for the cause of ham radio and are generally all around good guys, but I feel that amateurs need to know about dealers who may treat you less than fairly.

Wayne, your magazine is always touting that hams do more "policing of their own." How about starting a column in *73* that would be a consumer advocate for hams? Other publications do this with more than just a little success, as business people who want even more business are anxious to have their good customer relations broadcast as far as possible. Those who are out only for a quick buck also deserve the same. With the weight of *73* behind such an effort, I'm sure the results for those who need such a service would be good.

Carl Hattan KØBZV, Melbourne FL After reading your "Never Say Die" column in the February issue of *73*, I felt I should really drop you a personal note.

I have been a *73* reader for over 30 years. I remember when the magazine was a lot smaller and I would buy it, at the time, at World Radio Labs in Council Bluffs, Iowa. A lot of the Saturday morning hams who hung out at Leo's place acted as my elmers.

Like you, amateur radio was my ticket in the military to a 20-year career as a communications equipment repairman in the Air Force. I spent 15 months in Vietnam as a forward area maintenance man so someday maybe we will meet and swap a few tales. I can still hear the "Whoosh-Boom" of those incoming rockets!!

As I am writing this, I am waiting for my ride to the airport to get to southern Missouri to pay final respects to my mother. The latest *73* is going as I need something interesting to read to keep my mind off the reason I am traveling. About 12 years ago, *73* made a similar trip so I could pay last respects to a sister. I would like to thank you for helping me over some real rough spots in my life.

I took another page from the "Wayne Green Book of Life" also. I knocked off the cigarettes and beer and got back into ham radio with something besides a 2 meter handheld. The radios and most of my will to do anything went with a bankruptcy a few years ago. After sitting around feeling sorry for a while, I got my hands on an old Heath HW-16, fixed it up, and am now having the time of my life working CW with homebuilt keyers, homebuilt paddles, and homebuilt antennas. The motivation for this came from the pages of *73*. My six-year-old daughter is rapidly learning the code and enjoys being able to "talk" without Mommy having the slightest idea of what's going on. Maybe the XYL will get hooked, even if in self-defense. I am working with a young man down the street who likes the idea of ham radio. We chop up a whole lot of PVC pipe and wire and, in general, have a lot of fun with antennas.

What I am trying to say, Wayne, is that you are right when you say, "Get off your lazy butt and do something!!" I found that amateur radio is a lot better therapy and cheaper than doctors. A hundred bucks (one hour with a shrink) can buy a lot of wire, parts, pipe and other stuff and I have something to show for it afterwards. Although I work CW, I am not one of the old "CW forever"crowd. Whatever it takes to get these young people into the hobby should be done. Having had a whack at about all the modes of ham radio, I decided that QRP was an interesting thing and I am busy building little transmitters, receivers, and antennas as well as taking receivers to schools and the day care center to monitor the space shuttle during the missions. I am extremely fortunate to have an employer who will let me do this without too much grumbling.

I have heard and read about you being a "rabble-rouser" and "instigator."If the benefits I am getting from the hobby are any indication, I am proud to be counted among "Green's Rabble."I have found that you are never too old to have a whack at something. Who knows, you might like it! A lot of my dreams have have been dusted off and revived. When my father goes to his final reward, please be around so *73* can make that trip with me too. Be careful what you say or write; somebody might pay attention!!

Thanks for a lot of years of fun and I hope we will enjoy a lot more.

Ken Uthus KT7E, Nine Mile Falls WA Last night I read your February *73* editorial (plus reviewing January) and they left me with a few questions. Are you sincere when you say that we hams can pull ourselves out of the slime pit that we have built and live in? I see us as a bunch of alcoholics who have not yet reached the bottom of decline so we can't see the threat to our bands. We are striking out (like our mediocre president and his entourage of mediocrity to Japan) at the wrong enemy, who you well know is us. It seems to me that we will have to suffer some irreversible loss of bands before we wake up. Hams, industry and the country are without leadership. Emperor George Bush wants to be the Ruler of the New World Order and lacks interest in the U.S. so the country lacks the stimulus a leader provides. The aspirations of the ARRL president are beyond my reasoning so I have no sense of the direction if any that the league might be suggesting. Industry heads are into self promotion first and company performance second. Congress? Who knows what they might do next.

The parallels between our country and my recent readings of history telling me about the rise and fall of great powers frighten me. We are on the path to self destruction those other powers followed. Our country flared into a super nova during WWII before we were ready for the leadership role, bringing up the wrong people, from which we have never recovered. The bright star that was ham radio became a super nova on December 7, 1941, to be replaced with Operator Radio in 1946. A bunch of ex-military radios ops got their tickets and got on the air with surplus radio equipment and the exchange of handle, QTH, rig and WX began. Even then a rag-chew was tough to come by. We became a black hole in the late '50s—early '60s, along the same path of our country (the demise of the big bands accompanied us).

I don't mean to imply that nothing worthwhile came out of the "surplus era." I learned a lot using cheap surplus magnetrons, klystrons, 3' dishes, UHF receivers and the like. Three of us had contacts on a 500'-long path at 3 GHz (more or less) with that surplus equipment. We used gold-plated diode detectors (1N21?), klystron local oscillators, UHF receivers for IF and CW magnetron and modulated klystron transmitters. We earned credit in 1947 toward an engineering degree for that effort. However, surplus equipment was the beginning of radio kits. It was so simple to modify an ART 13 for a quick 500-watt CW rig and 50 watts of AM, so why bother to build from scratch? Surplus provided cheap "kit" construction and that ended scratch construction in general.

Maybe I'm too cynical but I can't see any hope for ham radio. It seems to me that we have the "right" to our frequencies if we have something to contribute. At one time we made big contributions to the art of radio. At one time we made big contributions to emergency traffic. When was our last contribution to the state of the art? How much assistance do we really provide to emergency communications? Oh sure, we are great when it comes to assisting at parades and other scheduled social events, but when the Red Cross or other emergency body needs help, where are we if the call is inconvenient to us? The usual dedicated few show up but where are the members of ham clubs?

Ma Bell first used SSB in the mid '30s and started conversion to digital in the '60s, about the time we hams were getting into SSB. Who said we are slow to pick up new technology? When I was first into ham radio in the late '30s, I remember a couple of hams who worked for Ma Bell demonstrating DSBSC and discussing SSB. If WWII hadn't come along, we just might have been into SSB 20 years sooner than we were because we had the experimenters at that time. Where did they go? Nothing short of a drastic reduction in band allocations will prompt us off our gibbering butts to bandwidth-efficient digital systems. Like the rest of the country we are market-driven and gave up development long ago. So when the market makes digital available, we will merrily jump to the market tune by necessity because we won't have the fat in our bands to feed our glutinous FM and SSB frequency hogs.

Next question: Do you believe the FCC will approve TDM or some other digital system for hams? My limited experience with TDM suggests that it is really easy to encode traffic which is a no-no to the great regulator.

I admire you for your "Never Say Die" pep talks because we badly need someone in the editorial world who is seeing what is happening to us plus has the guts to tell us how it really is. Here comes the "but" part: But we don't have a prayer of saving all of our bandwidth. We don't deserve our frequencies. However, the marketing forces will protect us from ourselves with appropriate lobbying, hopefully, until we can get digital on the air if we can get the approval. But even the big boys can't save all of our precious real estate.

Keep pushing. You just might get the OK and get some digital experimenters on the air and then we'll be off and running.

8,000 Channels for the Ramsey FX-146

Add direct frequency input to this popular 2 meter transceiver kit.

by Cecil A. Moore KG7BK

The Ramsey FX-146 is a good little 2 meter transceiver. It has reasonable sensitivity and selectivity, and outputs 5 watts. It covers 140–180 MHz in five kHz steps. That's a whopping 8,000 channels for $150! Unfortunately, it only has 12 channel positions on the selection switch. This article describes how to access all 8,000 frequencies (140–160 MHz) for about $25 worth of parts. I previously applied this technique to my ICOM-22S to obtain 720 channels.

Thumbwheel Frequency Selection

The FX-146 is normally programmed by soldering diodes into a binary matrix that is 16 bits wide. Two EPROMs can completely eliminate the primary selection diodes and the selection switch. An EPROM (Erasable Programmable Read Only Memory) can be thought of as a large diode matrix at a cost of around 0.01 cents per diode. A

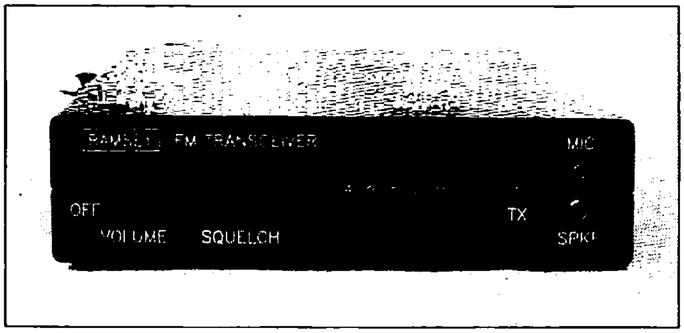


Photo A. Modified front panel of the Ramsey FX-146 2 meter FM transceiver showing the thumbwheel frequency switches.

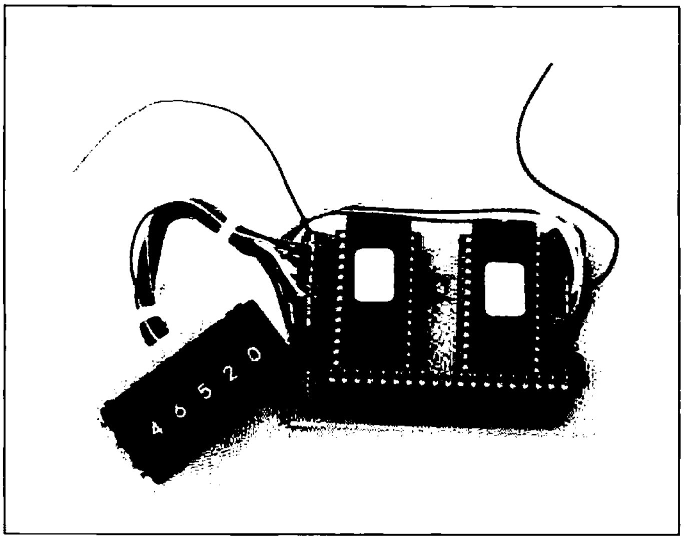


Photo B. The completed EPROM board and thumbwheel switch assemblies. Note the 19-pin header which allows the circuit to plug in directly to the FX-146 PC board.

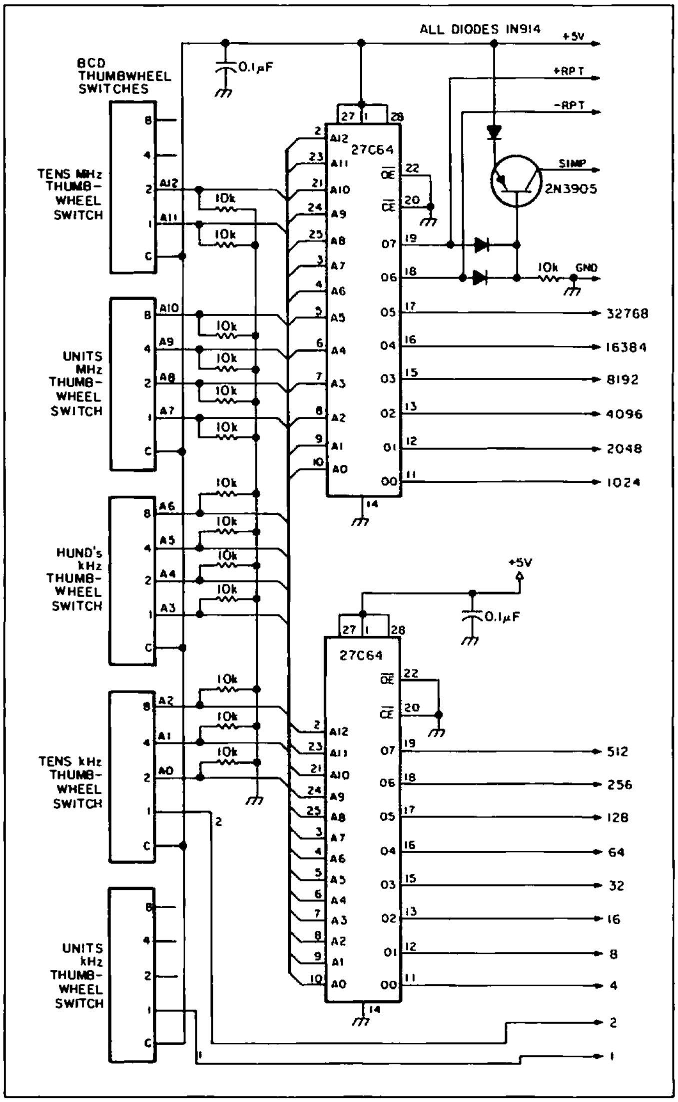


Figure 1. Schematic diagram for the 8000-channel EPROM board.

binary address is input to the device and binary data comes out. The 27xxx series of EPROMS are very popular in microcomputer applications. An address is input and eight data bits are output. The larger the memory, the more address bits are required.

All 8000 channels (40 MHz/5 kHz = 8,000) can be accessed in the FX-146 using two 27C64 EPROMs (cost around $6 each) and five inexpensive BCD (Binary Coded Decimal) thumbwheel switches available for about $2 each on the surplus market. The Cherry T59-02M, available from the Newark catalog, is a perfect fit but costs $5.50 per digit. The five thumbwheel switches are used to enter the frequency in decimal. Thus, for 146.520 MHz, 4, 6, 5, 2, 0 would be dialed into the thumbwheels. The EPROMs accomplish the translation from the thumbwheel BCD frequency information to the binary number required by the FX-146.

The resolution of the FX-146 is 5 kHz. Therefore, the units-of-kHz (if the thumbwheel or toggle switch) selection is only one bit, i.e. binary (0 = zero or 1 = five), and is routed directly to the FX-146 selection logic without being translated by the EPROMs. The same thing happens to the LSB (least significant bit) of the tens-of-kHz switch. The rest of the bits coming from the thumbwheel switches are BCD and require a translation from BCD to binary. This design requires BCD thumbwheels; do not use any other type. Be sure to leave the 100k pull-down resistors, R71-R89, installed in the diode matrix area.

The simplex transmit information requires 14 bits from the EPROMs. The other two bits are programmed with transmit offset information. One bit is used for the −600 kHz offset and the other bit for the +600 kHz offset. Figure 1 shows the schematic of the circuit. The offset matrix is programmed as usual with the diodes as shown on the schematic except that the aux split diodes may be eliminated. The two high-order bits from the EPROMs determine whether there is a transmit offset or not. If there is no transmit offset then the transistor circuit automatically generates the simplex transmit signal.

Interfacing with the FX-146

The printed circuit board is designed to align with the diode matrix cathode holes in the FX-146 PC board. Vertical solid wires can be used to mount the EPROM board piggy-back to the FX-146 mother board. To

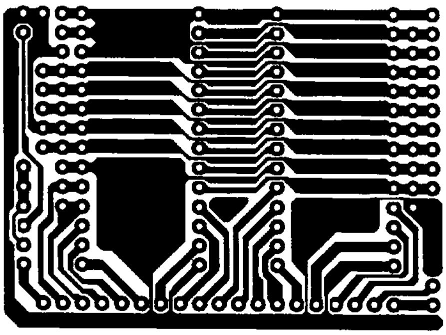


Figure 2. PC board foil pattern for the EPROM board.

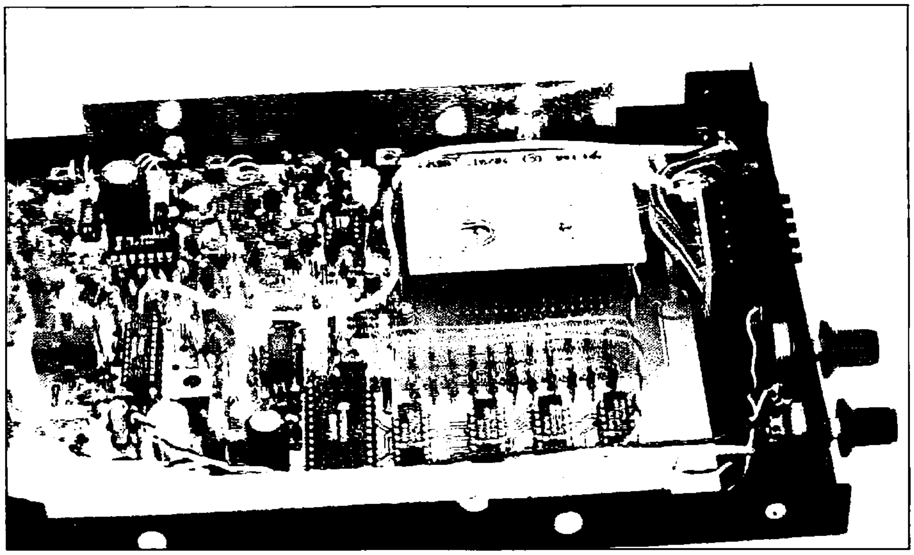


Photo C. Inside view showing the new EPROM board attached to the diode matrix area of the Ramsey FX-146.

Program to Determine EPROM Frequency Select Data

```
10 FOR N% = 7000 TO 9000
20 F = (20*N%)
30 FF=(F-140000!)/10:FFF%=FF
40 UFF%=FFF% MOD 10:FFF%=FFF% \10
50 TFF%=FFF% MOD 10:FFF%=FFF% \10
60 HFF%=FFF% MOD 10:FFF%=FFF%  \10
70 ADR%=UFF%  2+TFF%*8+HFF%*128+FFF%*2048
80 PLDATA%=N% MOD 256
90 PHDATA%=N%  256
100 IF F>=145100! THEN IF F<145500! THEN PHDATA%=PHDATA%+64
110 IF F>=146600! THEN IF F<147000! THEN PHDATA%=PHDATA%+64
120 IF F>=147000! THEN IF F<147400! THEN PHDATA%=PHDATA%+128
130 PRINT "FREQ", "NUMBER", "EPROM ADR", "HIGH BYTE", "LOW BYTE"
140 PRINT F,N%*4,HEX$(ADR%)"H",HEX$(PHDATA%)"H",HEX$(PLDATA%)"H":PRINT
150 IF INKEY$="  THEN GOTO 150
160 NEXT N%
170 END
```

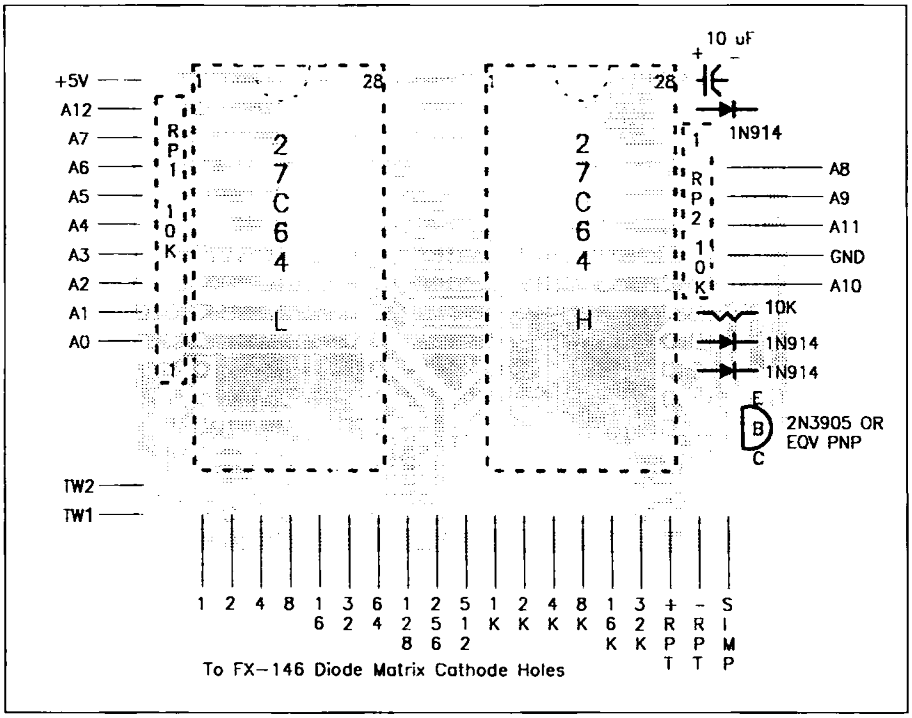


Figure 3. Parts placement for the EPROM board.

make it easier to remove, you can mount a 19-pin SIP (Single Inline Package) socket directly to the FX-146 board and attach a 19-pin header to the EPROM board. If you use individual header pins, you can line them up by sticking them in the SIP socket and lining them up with the holes on the EPROM board. Then just solder the pins in place.

You can use a 20-pin socket and header and just cut them down to 19 pins (see the parts list). You'll have to wire the EPROM board up to +5 volts and ground points on the FX-146 board as well.

I attached the 19-pin header to the component side of the EPROM board so it can be plugged directly into the FX-146 board. The foil side of the EPROM board should face up towards you when it's in place (see Photo C).

If you plan to mount the thumbwheel frequency select switches on the front panel just cut out a hole in the panel to allow a snug fit for all five switches. Just run wires from the thumbwheel switches over to the EPROM board as shown in Photo B.

Power up the Ramsey transceiver and you should now have a very versatile 2 meter rig with direct frequency input.

Since the diode matrix area of the FX-146 seems to be relatively free of RF, the board worked well as shown. However, if you should have any problems, you may want to add 0.01 μF ceramic capacitors from each address line to ground.

Programming the EPROMs

How are the contents of the EPROM determined? A BASIC program that yields the data is included in the sidebar. The −600 kHz duplex bit is set for 145.10-145.49 MHz and 146.60-146.99 MHz. The +600 kHz duplex bit is set for 147.00 to 147.39 MHz.

For the faint-of-heart who don't want to

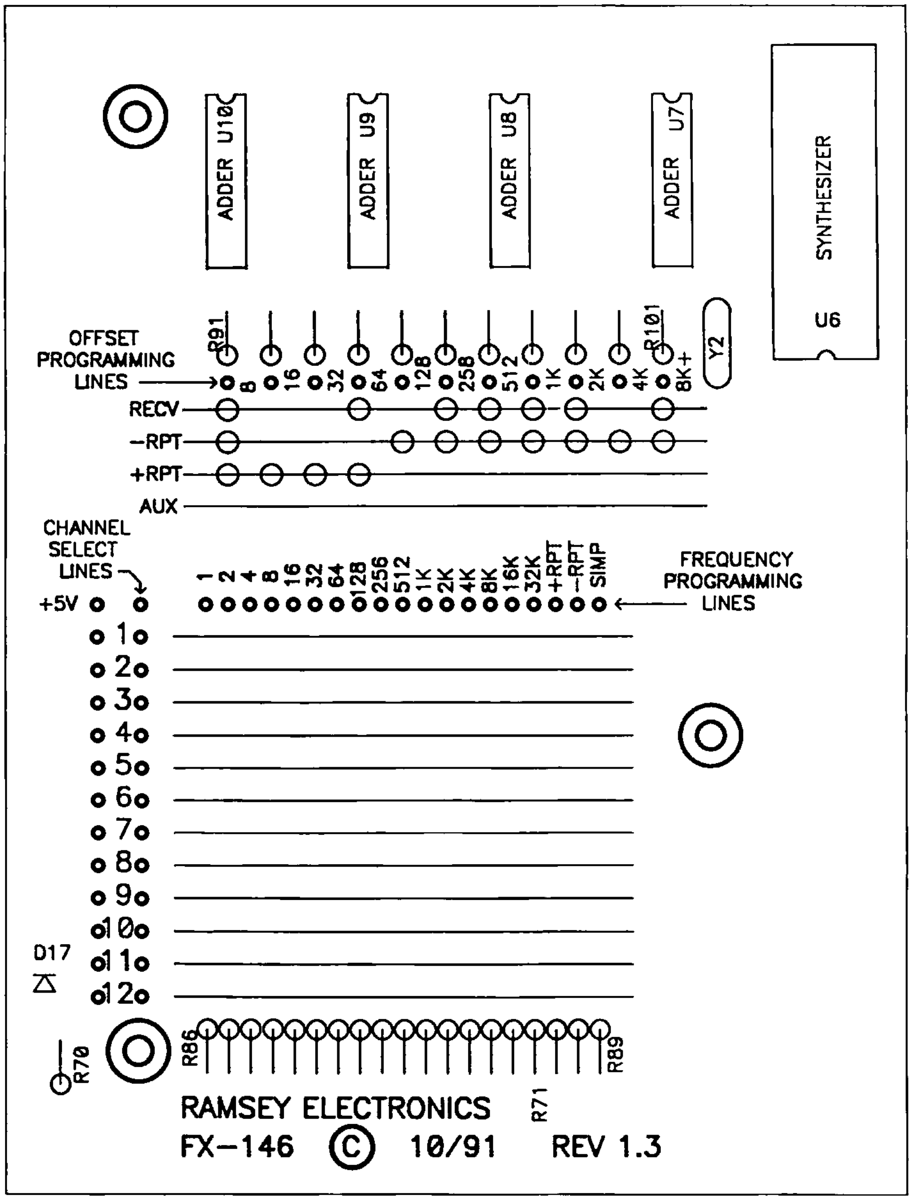


Figure 4. Attach the EPROM board to the frequency programming lines as shown here in the diode matrix area of Ramsey FX-146 PC board. You can either use a SIP socket to mount the EPROM board just above the FX-146 circuit or run wires from the EPROM board to the points shown here. +5 volts and ground are easily obtained from the Ramsey board as well. Diagram courtesy of Ramsey Electronics.

roll his/her own EPROMs and PCBs, preprogrammed EPROMs, the PC board and a complete set of instructions are available for $39.95 plus $2.00 shipping and handling from DH Consulting, 1803 Mission St., Suite 308, Santa Cruz CA 95060.

The BASIC program for obtaining the HEX address and HEX memory contents for the two EPROMs is listed in the sidebar on the previous page. ■

Contact Cecil A. Moore KG7BK at 18534 E. Via de Palmas, Higley AZ 85236.

Modification for Blind Hams

The BCD thumbwheel switches can be replaced with toggle switches arranged in a BCD pattern that is easy to learn. For instance, to switch in 146.520, the switches would be in the following pattern:

4	6	5	2	0
00	0110	0101	0010	0

A "0" is off and a "1" is on and represents the identical pattern that results from the thumbwheel switches. A total of fifteen toggle switches are required to match the thumbwheel outputs. However, if only amateur band coverage is required, the first three switches can be omitted. If 10 kHz spacing is adequate, then the rightmost switch can be eliminated, resulting in a total of just 11 toggle switches.

Parts List

Qty.	Description
2	27C64 EPROM
2	24-pin standard DIP IC sockets
1	10 µF tantalum capacitor (Newark #87F5118)
3	1N914 diodes
1	10k resistor SIP pack, 6-pin (Newark #81F9597)
1	10k resistor SIP pack, 10-pin (Newark #81F9601)
1	10k, ¼-watt resistor
1	2N3905 PNP transistor or equiv.
5	BCD thumbwheel switches (Newark #90F2080)

The following items are not required, but make the board pluggable:

1	20-pin SIP socket (Newark #89N6182)
20	Pin terminals (Newark #65F1610)

The two programmed EPROMS and a PC board are available for $39.95 plus $2 shipping and handling from DH Consulting, 1803 Mission St., Suite 308, Santa Cruz CA 95060. The SIP components are available from Newark Electronics, 4801 N. Ravenwood Ave., Chicago IL 60640; phone: (312) 784–5100.

VE3CYC's Wire Beam

Versatile gain antenna for a limited space.

by John Van der Ryd VE3CYC

Primarily designed for 15 and 20 meters, this beam does a fair job on 12 and 10 meters as well, and also works like a regular dipole on 17 meters.

Some Basic Advice

When building an antenna, keep in mind that there is a considerable difference between bare wire and insulated wire. The actual length of insulated wire must be considerably shorter than bare wire to arrive at the same resonant frequency. The opposite is true if you use bare wire instead of insulated wire—a piece the same length as a piece of insulated wire will give a higher resonant frequency.

We have all noticed how our antennas misbehave when they get wet or are covered with ice. Just watch your SWR meter go up when that happens. This is because the dielectric constant is not the same as it would be if dry air surrounded the bare wire. The purpose of the antenna is to create alternating magnetic and electrostatic fields around itself at the operating frequency. These fields are continuously pushed away into the surrounding space at the speed of light. It is the resistance, created by the material enclosing the wire, which slightly opposes the radiation of these electrostatic fields (resisting the flow of electrons in the antenna.) This means that the antenna has to be shorter to be resonant again at the original frequency. This is a blessing in disguise because, although it has no apparent effect on the propagation of our radio waves, it makes the antenna a little bit smaller.

If you want this antenna project to be successful, follow my instructions to the letter and stick to my dimensions. Before I get involved in the actual beam antenna I will first describe how I made a good working multiband dipole antenna. You might even decide, after reading this part, to make just the multiband dipole instead of the unusual "VE3CYC's Wire Beam."

I used flexible insulated wire in both the multiband dipole and the multiband beam antenna. The insulation prevents corrosion, while also making the antenna shorter and nicer looking.

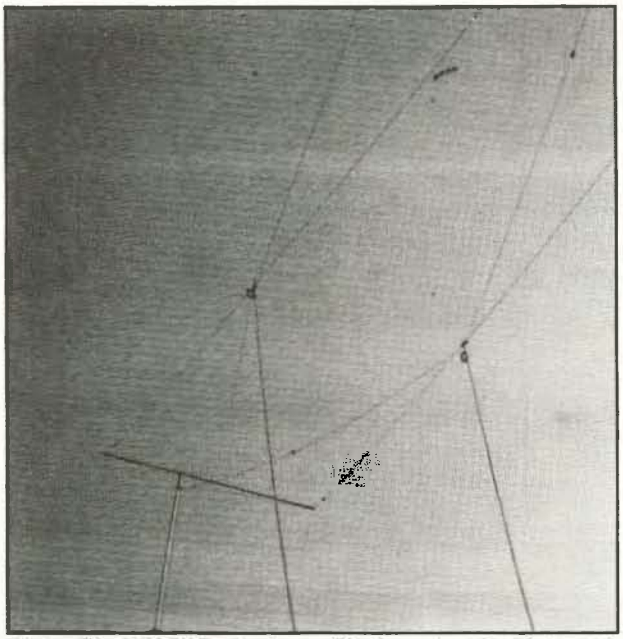


Photo. The VE3CYC wire beam. The beam is raised into position by pulleys and nylon rope supports attached to vertical masts.

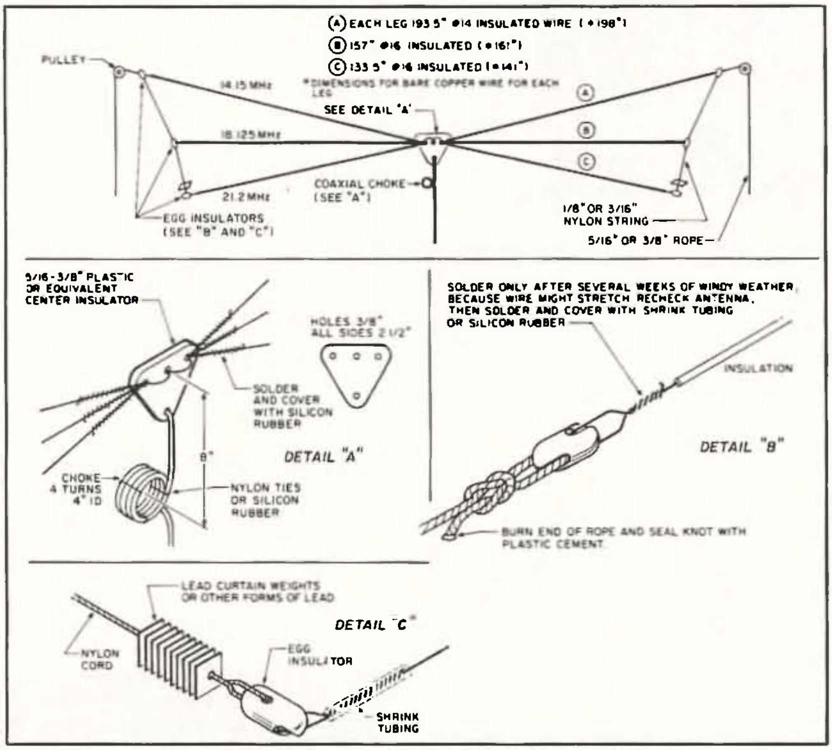


Figure 1. Construction details of the multi-band dipole.

How It Got Started

Let me tell you something about the history of my QTH because it led up to this amazingly simple, effective, and handy multiband wire beam antenna. Quite some time ago my better half and I decided to make our QTH a bit more presentable, with the idea of putting it up for sale and buying that "one-acre estate out in the country," which every ham dreams about. The thought of having an antenna farm at my disposal really turned me on—something to do during the Golden Years.

After spending many hours painting, etc., my XYL suggested that I take that ugly beam (a commercial 3-element tribander) down too. She figured that a colossal TV antenna like that would certainly turn prospective home buyers off. So down came the old faithful beam, and I sold it about a year later, realizing it was no good to me laying in our basement gathering dust. After all, once I got that Golden Years QTH, I would have lots of time to build my own monobanders (including

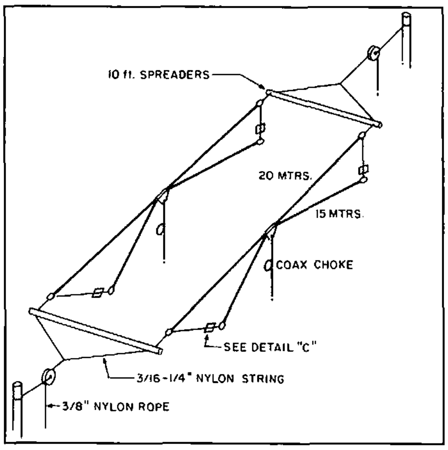


Figure 2. The wire beam for 15 and 20 meters (first version).

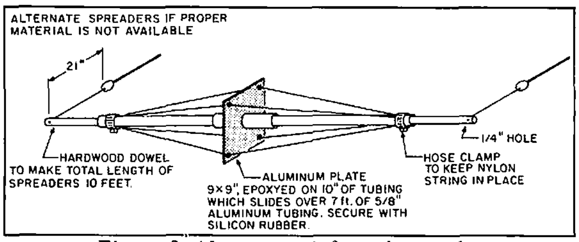


Figure 3. Alternate reinforced spreader.

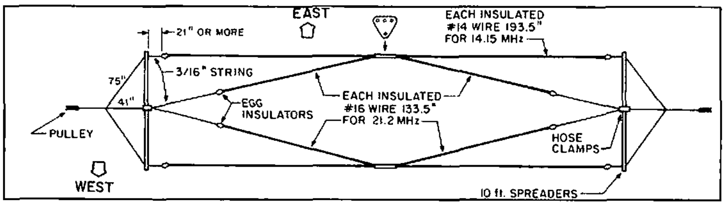


Figure 4. Top view of the improved wire beam. The 15 meter elements now have less tendency to move in high winds.

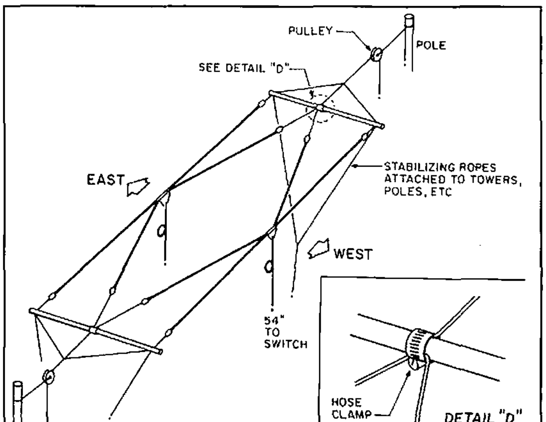


Figure 5. Side view of the two-band wire beam showing attachment points of the stabilizing ropes.

all WARC bands).

Well, to make a long story short, we never did sell the house. And I found myself without a good antenna system except for an all-band vertical that I cooked up a few years ago. I am not knocking verticals—they have their place, but just try to listen to the people you are working while five stations from the side or rear are also coming through equally strong. Not to mention the high atmospheric noise levels coming from the east after nightfall. All of which you can greatly reduce with the use of a good beam antenna.

My First Attempt

Since I already had a 40-foot tower anchored to the roof of my house and a home-brew tilt-over all-band vertical separated by 45 feet from the tower, I used these as supporting structures for some horizontal antenna experiments. After installing a pulley and nylon rope on each of these I was able to pull up any type of wire antenna I wanted. I looked at antennas like the "W8JK" (and variations of it) and the "ZL-SPECIAL," but decided to give the multiband dipoles fed by one common feedline a try.

The problem with them is that unless you can really separate the wires from each other enough, there tends to be a lot of coupling between the individual dipoles. And as a result, there is a lot of interaction which, because of capacitive coupling, makes them hard to load up on each individual band and also causes high SWR readings.

This is especially true for the ones made from rotator cables or open wire feedlines. Stay away from them—you will be wasting your time, unless you use a good antenna tuner. But then you are only fooling yourself into thinking that your antenna presents a perfect match, and all your RF is being radiated into space. After all, your SWR is almost 1:1, right? Wrong!

Unless your antenna presents a purely resistive load (as should be the case with a resonant antenna like a dipole or a nonresonant traveling wave antenna, such as a terminated long wire, or a terminated rhombic antenna, etc.) a good percentage of your RF is being radiated within the confines of your tuner and not getting anywhere, just being converted into another form of energy, which we call "heat."

Constructing a Multiband Dipole

Disappointed by these experiences, I decided to make a conventional dipole for 20 meters. Using 14-gauge insulated automotive stranded wire, I started with the proper length, based on the formulas in the *ARRL Antenna Handbook*, which of course were meant for bare copper wire.

Here is where I found out about the effect of the insulation on the wire. I ended up with a dipole that was much shorter than I had anticipated. Each leg of the 20 meter dipole made from bare 14-gauge wire would normally have been about 198"; instead, mine was 193.5".

Quite a bit of difference. My SWR was 1.2:1; not bad. It got out pretty good like a dipole should, and I had less trouble with interfering stations from the sides.

Then I decided to attach a second dipole to the first one, this time for 17 meters, and made it from 16-gauge automotive insulated wire, simply because that is what I had available. The length for each leg was now 157", as opposed to 161" for bare wire.

I experimented with the spacing between the legs of this 17 meter dipole, and the 20 meter dipole. I found that as long as I kept the angles between each leg at least 12 degrees I had a low SWR, still 1.2:1. Then I added a third set of legs made from the same 16-gauge wire, this time for 15 meters, using the same 12 degree spacing. The length for each leg was 133.5", as opposed to 141" for bare wire. Any more dipoles would have meant an angle of close to 90 degrees for at least the fourth dipole. This was not acceptable to me. Therefore, I kept it as a three-band antenna with a SWR of 1.2:1 or better.

So now I had a three-band dipole, bi-directional, with sufficient side rejection to make it more useful than my old faithful all-band vertical in most cases.

For those of you who would rather have a 10 meter addition instead of any of the other bands: The dimensions for each leg will than be 96.75" for 16-gauge insulated automotive wire, and 98" for bare wire.

See Figure 1 and details A, B and C for all the construction information. The coaxial choke in detail A consists of four turns and 4" i.d., suspended about 8" below the dipoles. It is part of the same feedline which goes to my station, and is kept together with three or four nylon ties. Or use silicon rubber instead.

The purpose of this choke is to keep your feedline from radiating, which can not only distort your field pattern but also radiate RF into areas where you don't want it (like your neighbors' telephone, VCR, TV, hi-fi, or the fillings in their teeth, etc.).

Detail C shows how I weighted down this multiband dipole with curtain weights by drilling holes in them and slipping them over the nylon suspension ropes. I used about 10 on each side, and that kept the antenna stable under most conditions. Try your local hardware store or interior decorator for these things.

The Dream of a Wire Beam

After successfully using this multiband dipole for a while, a new idea came to my mind. I remembered reading articles about hams using identical wire loops, spaced from each other, each with its own feedline, to make cubical quads. While they were being installed in a fixed position these quads could be made to change directions simply by adding a coil with the proper dimensions to the feedline of the loop which was not hooked up to the rig. This was to make it longer, making it act as a parasitic element. Thus, by feeding one of the loops, the other could be made to act as a reflector.

After eliminating the 17 meter dipole, I was left with only 20 and 15 meters, still being kept 12 degrees apart (57" between the insulators). After satisfying myself that

Continued on page 34

Number 6 on your Feedback card

Touch-Tone Squelch

Remote speaker control with a DTMF decoder.

by Patrick Wong VE3RGW

DTMF (dual-tone multi-frequency) is a very successful and popular remote control system. We can hardly imagine a hand-held radio without a touch-tone pad. First generation DTMF decoders typically used passive LC filters, active filters or phase-locked loop techniques to decode DTMF tones. They were either expensive or they suffered serious drift with changes in temperature or humidity.

DTMF decoding ICs are much cheaper and reliable now. This article describes how to build a general purpose DTMF decoder with a low-priced chip from MITEL. The circuit supports DTMF squelch based on a three-digit station ID (full 999 combination). It also supports decoding of four additional commands—station ID, plus one more digit which can be used to perform remote control on external devices (on/off or single-shoot trigger operation). One expansion port is included to allow future development.

The core of the whole equipment is the MT8870 DTMF decoder. This is a state-of-the-art single-chip DTMF receiver incorporating switched capacitor filter technology and an advanced digital counting/averaging algorithm for period measurement. Conventional methods of frequency decoding are usually based on frequency-counting or phase-locking techniques. These methods are time consuming and inaccurate when handling unsteady, complex signals.

Switched capacitor filter technology is based on a completely different approach. It works on the theory that any AC signals are rapid changes of potential energy under specific timing. AC components, provided they bear the same frequency characteristics, will have the same timing on instantaneous potential variation. For example, a signal of 1 Hz frequency will experience a peak positive value once every second. The duration of one second will be constant among any AC signals bearing a 1 Hz frequency, even though they have different waveforms.

Suppose a circuit is designed to sample the potential value of a signal at preset intervals (say, at exactly 90 degree phase-shift timing for a specific frequency). If signals are really present but the total sum of all samples always experience zero, we can conclude that an AC component of that specific frequency has been identified. Each fixed timing will be good for only one frequency. Since DTMF is a combination of four row tones and four column tones, it will need at least eight sets of such time-switching circuits. In the real world, there are more than eight sets of such circuits in order to handle acceptable frequency tolerance in the incoming DTMF signal while decoding results are developed on an averaging of outputs from all these filters.

Error Detection Control

There are two kinds of DTMF detection errors: TALKOFF and TWIST.

TWIST is the failure of decoding a valid DTMF signal due to non-linear frequency response of a transmission media. Among the two enemies, TWIST is easier to deal with since it can be controlled by audio equalization on the whole transmission path. These equalizations can be done internally inside the DTMF decoding chip, or externally as additional filters. According to factory specification, MT8870 can stand TWIST tolerance of +/-6 dB. That is quite sufficient to compensate for the pre-emphasize and de-emphasize distortion caused by FM media. This should not be a problem unless the transmission is highly distorted.

TALKOFF is the incorrect recognition of the DTMF component in human voice as true DTMF signal. This is an unavoidable factor since human voices do contain valid DTMF combinations. Fortunately, the presence of these valid components is unsteady. Unlike real DTMF from a touch-tone keyboard or generator, these "human" DTMF signals cannot maintain a constant combination, so they can be isolated by DELAY discrimination. If a decoded DTMF signal can stay on constantly for a certain duration which exceeds those normal periods experienced in human voice, then it can be identified as a real DTMF command.

Look at the schematic circuit. There are some external components hooked to MT8870 (C2,R11,R12,D9). Pin 16 of MT8870 is the EST (early steering) output. It will flag logic high whenever there is a DTMF combination present in the input signal (including TALKOFF error detection).

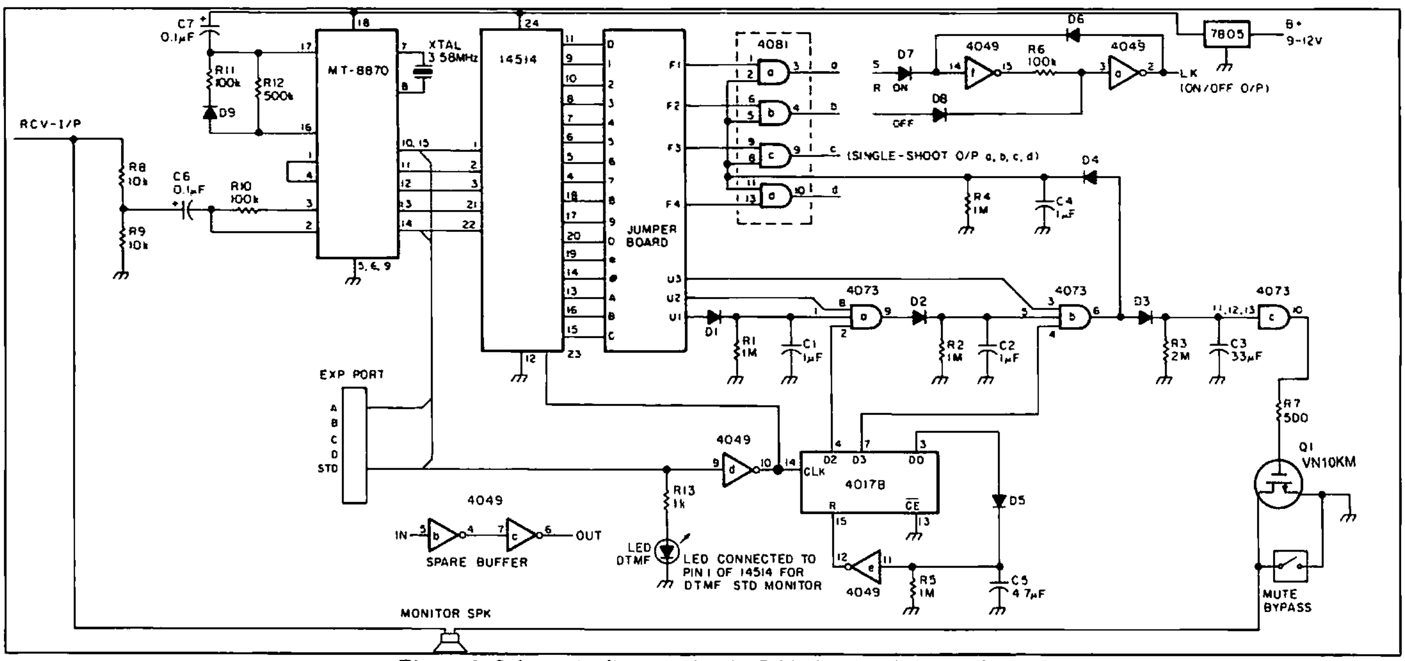


Figure 1. Schematic diagram for the DTMF squelch controller.

Pin 17 is the GT (guard time) control; it is a trigger-type input. The level on pin 17 is arranged as a delayed EST via C7 and R12. If the detection of DTMF is long enough for voltage at pin 17 to build up with time, it can be considered a valid DTMF signal. The STD output line (pin 10) will flag logic high since it is connected to output data, enable (pin 15). That will enable lines (pin 11,12,13,14) to present a numeric value for the decoded DTMF data. Yet, it takes the same delay for an RC circuit to discharge. That means TALKOFF detection can still occur after a valid DTMF signal has disappeared while C7 is still charged up. That is the reason for including D9 and R11. They are there to provide a fast discharge on C7 and ensure an immediate full delay guarding once a valid DTMF tone is gone.

Circuit Operation

The circuit is pretty straightforward. The MT8870 monitors any audio coming from the receiver. The internal speaker of the receiver is muted while the external monitor speaker is switched by Q1 or a manual control bypass switch (Q1 is driven by the internal command decoding logic).

The decoded BCD numeric data follows the format shown in Table 1. This data is decoded into 16 individual outputs by the hex decoder. Simply speaking, if you received a DTMF "*" entry, you will get a logic high on pin 19 from the 14514. All these 16 outputs are connected to the program board, which is only a 16-pin DIP IC socket. U1-U3 and F1-F4 are input wires to the command decoding logic. The command programming is completed by jumping these wires into the corresponding pins on the program board. For example: If you want to program your station ID as number [330], you just have to plug wire U1 to pin 3, U2 to pin 3, and U3 to pin 10 of the program board—it's as simple as that!

The command decoding logic is just a bunch of gates combined with RC delay circuits, thanks to the extra high input impedance of CMOS. That makes it possible for electric charges to stay at their inputs for hours until absorbed by a shunting resistor. Let's take one simple section as an example. Look at the 4081 dual input gates. They form a simple two-digit command decoder. They are all connected to an RC circuit formed by R4 and C4. This RC will form a delay of about one second. That is to say, if there has been a logic high coming through D4, C4 will keep the charge and R4 discharges the circuit to a logic low level within one second. If another logic high is received on the second input (FI-F4 matches a selected DTMF tone received) before the discharge is completed, the selected gate will open and a logic high will appear at the output. This output can be used to drive external circuits. To change the delay duration, just change the RC values. The larger the resistance or capacitance, the longer the waiting delay on the second digit.

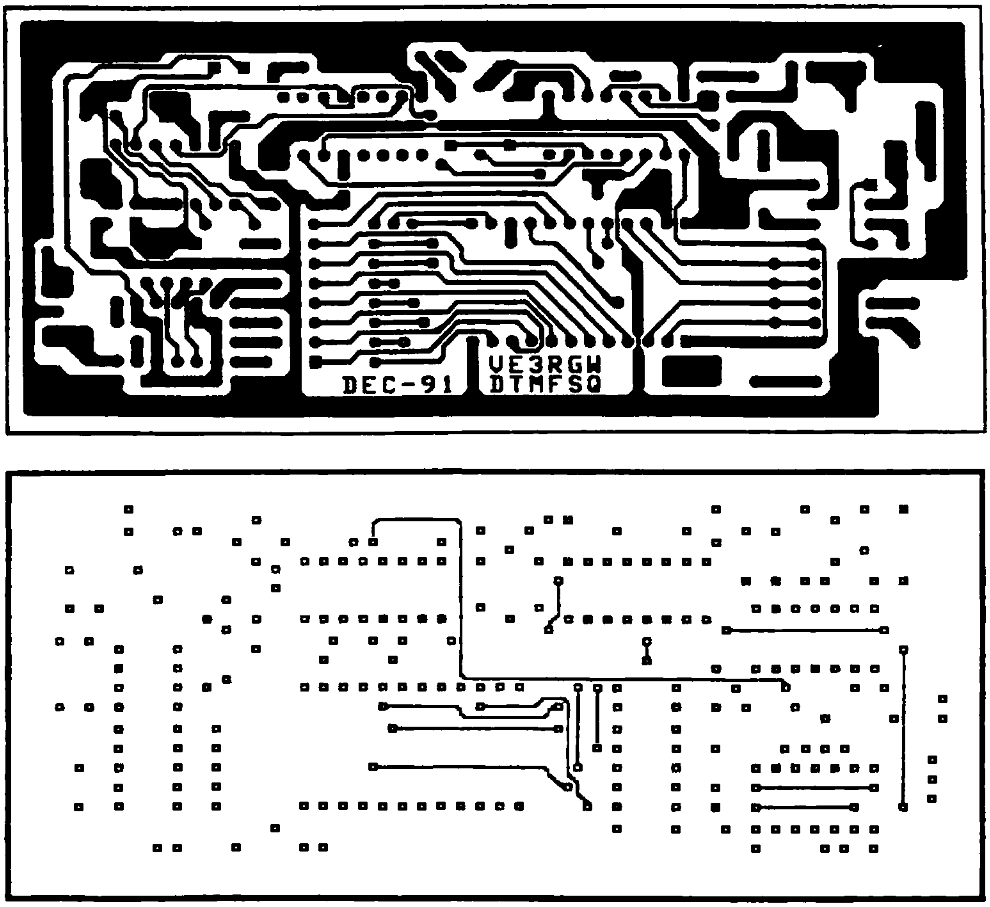


Figure 2 (a). PC board foil pattern (bottom layer). (b). Top layer.

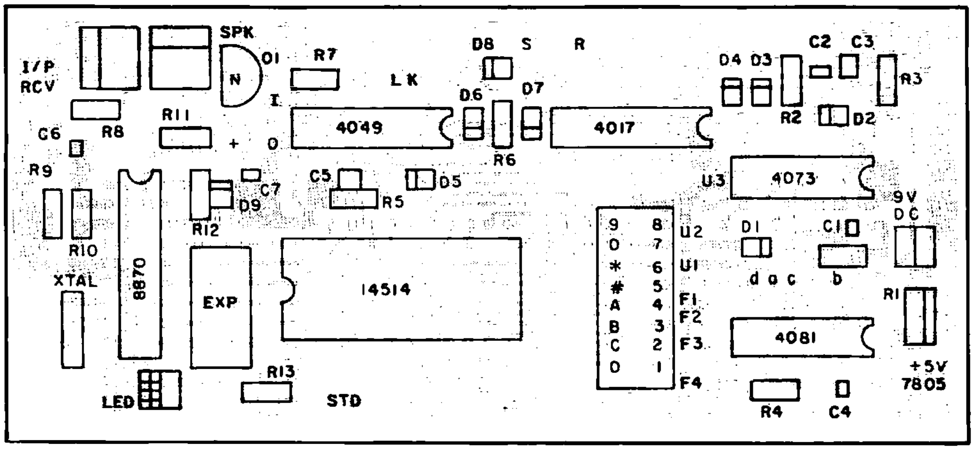


Figure 3. Parts placement.

One factor which affects the accuracy of these timings is humidity. This effect will be further emphasized if the resistance value is high (say, exceeding 5 megohms). A delay longer than 120 seconds is not recommended, although it can be approached (the typical value for a 120-second delay is 5 meg/47 µF). I chose tantalum capacitors because they are smaller and enclosed in a better package. Also, they can stand higher changes of temperature and humidity.

Now, let's look into the command decoder in more detail. U1, U2, and U3 are programmed as the station ID number. The 4017 is a decade counter equipped with auto-reset ability (via D5, R5, C5, and inverter E). The D0 pin is the output of decade stage 0, and it will stay logic high as long as the counter stays idle. C5 is charged up continuously until the first DTMF entry is detected. That causes the counter to step up by one, and D0 will go to a logic low status while D1 goes to a logic high state. Once that happens, the charge at the input of inverter E will be discharged by R5 and approach logic low within three seconds. In this three-second period the counter can still count DTMF activities and move the logic high status from D1 to D2 if a second DTMF tone is detected. Once the three seconds have passed, the 4017 will be reset and all command entry has to start from first digit again.

If the first digit of the DTMF entry is correct (matches U1), two inputs of the 4073 will be on logic high (supplied by 4017 D1

output and charged up C1). If the second digit of the DTMF entry is also correct (matches U2), the output of 4073/section A will go logic high and charge up C2. At the same time, since 4017 will move the logic high to its D2 output, the 4073/section B is now ready to decode the third DTMF digit via U3.

If a logic high is received from U3 within one second, a logic high will be presented from 4073/section B and charge up the two following circuits. The first is a 45-second delay formed by 4073/section C (just a buffer), the output of which will drive transistor Q1 and activate the external speaker until time-out. That is how the DTMF squelch becomes unmuted by detecting the station ID. The previously mentioned 4081 dual input gates are connected as additional remote control command decoders. Once station ID plus one more matching DTMF digit is received (programmed by F1,F2,F3,F4), the output of the corresponding 4081 will turn logic high while external devices can be triggered via the output points (a,b,c,d).

Additional Control Features

One special section is provided by the hex inverters. Sections A and F of the 4049 are connected as a toggle flip-flop. If a logic high is received on the [on] input, the output will stay logic high until another logic high is received on the [off] input. This is just an example of how to construct a self-locking on/off control circuit. You can connect output [a] to [on], and output [b] to [off], in order to program the [on] command as [station ID + F1] while the [off] command is [station ID + F2]. More control can be obtained in the same manner just by adding similar circuits.

If any error occurs in the command sending sequence, the counter will prevent further decoding immediately until the self-reset function executes. So, any command must be entered correctly within three seconds after a start. Do not hesitate more than one second between any two digits or the decode will fail due to time out. With such digit-by-digit checking, repeat numbers can be used consecutively in the station ID (except that digits F1,F2,F3,F4 should not be the same as U3 or the 4th digit for that command will be ignored). The command circuit will fire after the reception of the station ID since the whole four-digit command is already received, even though the user has not yet sent his fourth DTMF tone!

Since only four units in the 4049 hex inverter are in use, the two spare units are connected in series (on the PCB) as a spare non-invert buffer. This can be used for future expansion or making the LED monitor become a high impedance logic probe. This simple device is very useful for diagnostic work at the construction stage. As shown in the circuit diagram, the LED is connected to show DTMF detection, while the 4049 buffer is left vacant. Users can determine their own needs and change the connection accordingly.

DTMF character	Output data line DCBA
D	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
0	1010
*	1011
#	1100
A	1101
B	1110
C	1111

Table 1. Decoded BCD numeric data format.

Tune-Up and Testing

The only precaution to take when working with construction of this type is to be careful with static discharge on CMOS ICs. All the ICs should be kept inside their anti-static packaging until the last moment before they are transferred to the PC board. To avoid unnecessary damage, first solder all the jumpers on the component side. Then put on all the IC sockets. This sequence is important since some jumpers are hidden under the sockets. They will no longer be accessible after the sockets are in position. Next, put on all the resistors, diodes, capacitors, the crystal, Q1 and the LED. Finally, put on the 7805 regulator.

Connect DC power to the +Vcc input and measure voltage for the pins at all the IC sockets. You should see +5 volts ONLY on the Vcc supply pins. If +5 volts appears on any other pins you probabaly have a short circuit somewhere. Check out those shorts before an IC is toasted because of carelessness, then check the conductance of all the ground pins are actually grounded. Make sure the return path is also good.

Remove DC power from the board. Now you can insert the ICs onto the PC board and test them out one by one. First insert MT8870, then power on the board. Connect the RCV input to the speaker output of your receiver. Assume that the LED has been connected to the DTMF strobe line as suggested. Send DTMF tones into this receiver and increase the volume control of the receiver from silence until the DTMF LED on the PC board lights up. The LED should turn off once the DTMF tone is gone. MT8870s have a very wide dynamic range for the input DTMF level, so even very weak audio is sufficient. Don't overdrive the circuit; distorted DTMF is no good for decoding.

After you have verified that the chip is able to decode DTMF, enter all 16 tones and make sure every one makes the LED flicker. Next, use the voltmeter to check out the five data lines at the expansion port. STD should flag logic high (+5V), just like the LED does. The activity of the other data line should respond exactly as shown in Table 1.

Remove DC power and insert the MC14514, 4049 into the circuit. Turn the power on again and enter all 16 DTMF tones. Make sure a corresponding logic high can be seen on the correct pins at the program board.

Remove power again and insert 4017, 4081, 4073 onto the PC board. Complete the necessary programming for U1, U2, U3, F1, F2, F3, F4, then turn the power back on. This time, hook the voltmeter to pin 3 of 4017, then send in one DTMF tone. This pin should be logic high on idle, go logic low immediately after DTMF received, and restore logic high automatically within three seconds. Check out the inverter or D5,C5 and R5, if failure occurs. Also, make sure the logic high stage moves from pin 3 to pin 2, then to pin 4 of 4017 with consecutive DTMF entries.

Wait for three seconds (to ensure 4017's self-reset). Connect the voltmeter to pin 6 of 4073. Send in the DTMF tone for the station ID (U1 U2 U3) and make sure a logic high flickers once on the voltmeter. If this is successful and the external speaker is connected, you can hear the monitor speaker switch on. It will stay on until time-out occurs on R3 and C3 (within 45 seconds).

Move the voltmeter to the output of 4081 (pin 3,4,10,11) and check out their activity on sending in commands ID+F1,ID+F2, ID+F3 and ID+F4. If you have connected output [a] to [S] and output [b] to [R], by performing the above test on ID+F1 and ID+F2 you can also cause an on/off activity on output [LK].

The decoder is considered tested out after all of the above has been completed.

Endless Possibilities

The above is only a start for your entering the world of DTMF control. By using these DTMF switches, you can create unlimited applications.

Parts List

MT8870		Mitel DTMF decoder
MC14073 or 4073		Triple three input AND gate
MC14081 or 4081		Quad dual input AND gate
MC14017 or 4017		Decimal counter
MC14049 OR 4049		Hex inverter
MC14514		BCD to HEX decoder
7805		5-volt regulator > 50 mA
Q1	VN10KM	Power FET
R1	1M ohm	1/4 watt
R2	1M ohm	1/4 watt
R3	2M ohm	1/4 watt
R4	1M ohm	1/4 watt
R5	1M ohm	1/4 watt
R6	100k ohm	1/4 watt
R7	500 ohm	1/4 watt
R8	10k ohm	1/4 watt
R9	10k ohm	1/4 watt
R10	100k ohm	1/4 watt
R11	100k ohm	1/4 watt
R12	500k ohm	1/4 watt
R13	1k ohm	1/4 watt
C1	1 µF	30V tantalum
C2	1 µF	30V tantalum
C3	33 µF	10V tantalum
C4	1 µF	30V tantalum
C5	4.7 µF	16V tantalum
C6	0.1 µF	16V electrolytic
C7	0.1 µF	30V tantalum
D1-D9	1N914 or equivalent switching diode	
LED	low power consumption type	
IC sockets	24 pin x1, 18 pin x1, 16 pin x3 , 14 pin x2	

Etched and drilled PC board is available at $12 plus postage; the unassembled kit is $41 plus postage. Order from: Patrick Wong VE3RGW, 10 Halder Cr., Markham, Ontario, L3R 7E8, Canada.

Build Your Own 20 Meter Transceiver

Work the world with this easy-to-build rig.

by Gordon Young WB6NKJ

This project is perfect for the low-power enthusiast who wants full break-in (QSK), sidetone and diode antenna switching features. The parts for this project are common and even a first-time builder should have little or no trouble assembling a complete transceiver. You will be surprised at the results and happy with the simple features this rig provides. I have already logged many stations and have put on many hours of use, talking across the states and around the world with just a few watts. An advanced builder may consider adding RIT, audio filtering, a frequency counter, a drive control, or other features.

The power output will easily drive a pair of high-power transistors to a level greater than 100 watts, but alone it is enough power to work almost any station you can receive. With some tinkering, you can bring the MRF-433 transistor to its full 12-watt capability.

I am always surprised at the performance of simple direct-conversion rigs, and this one is no exception. The circuit is simple, construction is easy, and normal operation is a pleasure considering that the transceiver is so simple. I've worked all states before with just 5 watts; this rig should do the same for you.

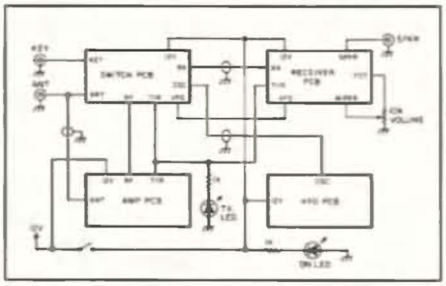


Figure 1. Transceiver block diagram.

The Circuit

Figure 1 shows the block diagram of the transceiver and it is readily apparent that it contains the basics: a signal input, a detector, VFO, audio amplifier and RF PA. This started as only a weekend project, but I wanted to make sure that it had some of the nice features I grew to depend on, such as a sidetone, diode antenna switching, and audio output to drive a speaker (headphones begin to get uncomfortable after hours of operation on Field Day). The other annoying aspect of full QSK is the "thumping" you normally get switching from transmit to receive. The cause of this is the DC dumping of the audio stage. To help overcome this problem I used a simple transistor switch between the detector and AF preamp. This switch doesn't really tackle the mismatch of impedances at this point; an FET would be better.

Another objective was that the power amplifier have enough guts to drive a linear stage to later follow the transceiver project. If you have a pair of 80-watt devices, they will require at least 5 watts of drive, and pushing the MRF-433 to 12 watts would mean that an attenuator would likely be needed somewhere in between.

The outcome of the entire effort is shown in the figures. In my prototype, each part of the rig was originally air-wired on plates of PCB board. However, etched and drilled are available to case your construction efforts (see the Parts List).

Starting with the receiver PCB, the front-end bandpass filter helps a lot to reduce the foreign broadcast interference that would overpower receivers such as this. To make up for the few dB lost in the filter and to add

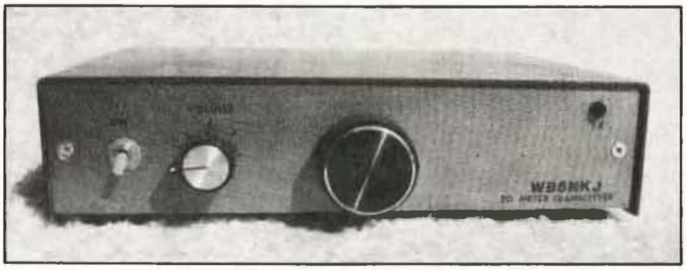


Photo A. The completed WB6NKJ transceiver.

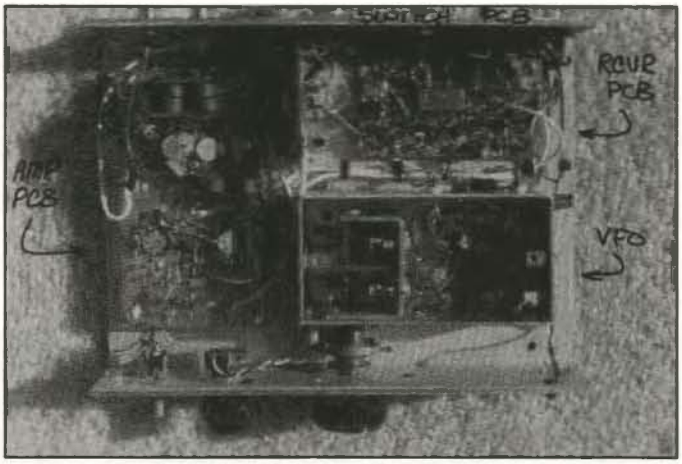


Photo B. Inside view of the transceiver.

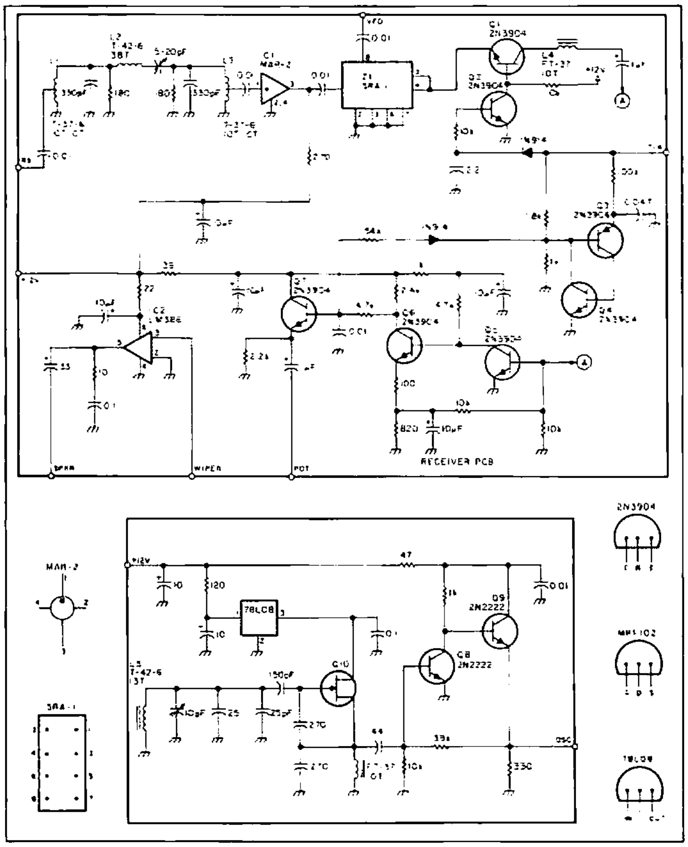


Figure 2. Schematic diagrams for the receiver (top) and VFO sections (bottom).

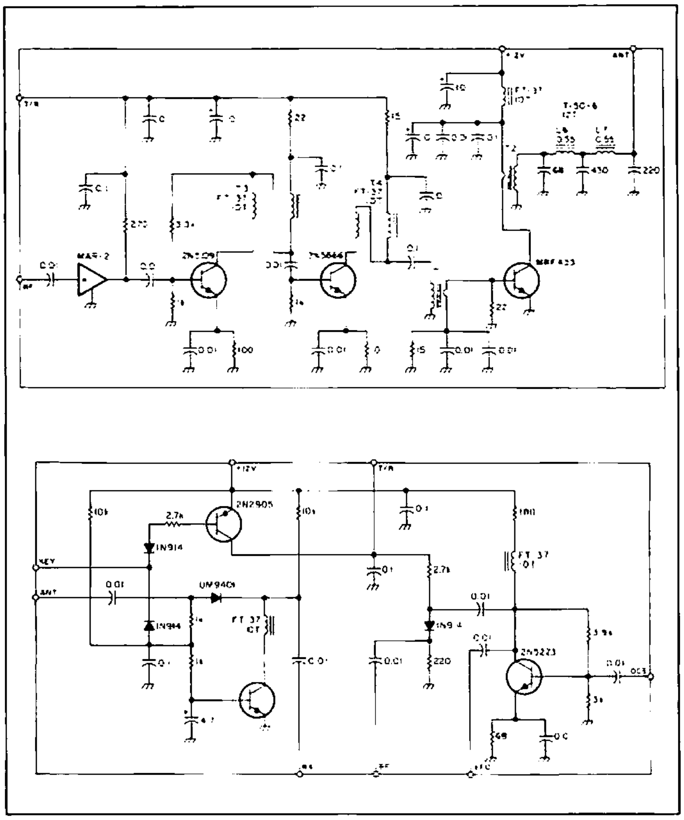


Figure 3. Schematic for the RF power amplifier (top) and the switching board (bottom).

some amplification ahead of the detector, a Mini Circuits MAR-2 (+13dB) amplifier is used. You can improve the performance somewhat by substituting an RCA MWA-130. Both are IC amplifiers and require very little more in the way of components. Since these are broadband amplifiers you need a bandpass filter ahead of them. Another Mini Circuits device, an SRA-1, is used for the detector. This represents another 6 dB of loss, but fewer components are used to complete the detection stage and the loss can be easily made up for in the audio preamplification stages.

Q1 and Q2 disable the detector during transmit mode and

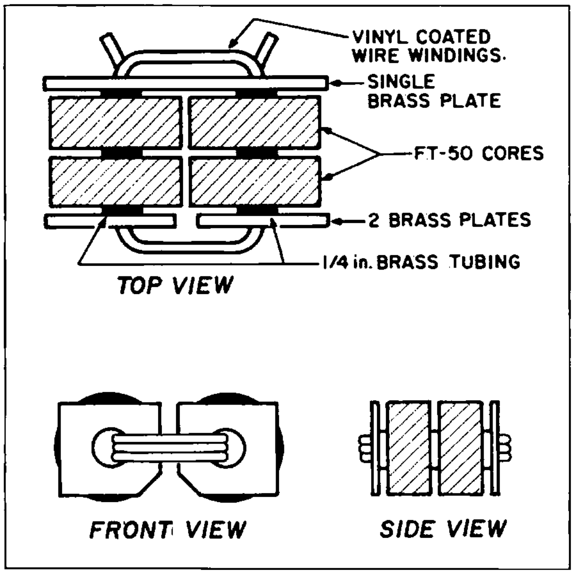


Figure 4. Broadband transformer winding information. T1 is constructed as shown above using just 2 FT-50 cores and a 7-turn primary. T2 is built as shown here with a total of 4 FT-50 cores and a 7-turn secondary.

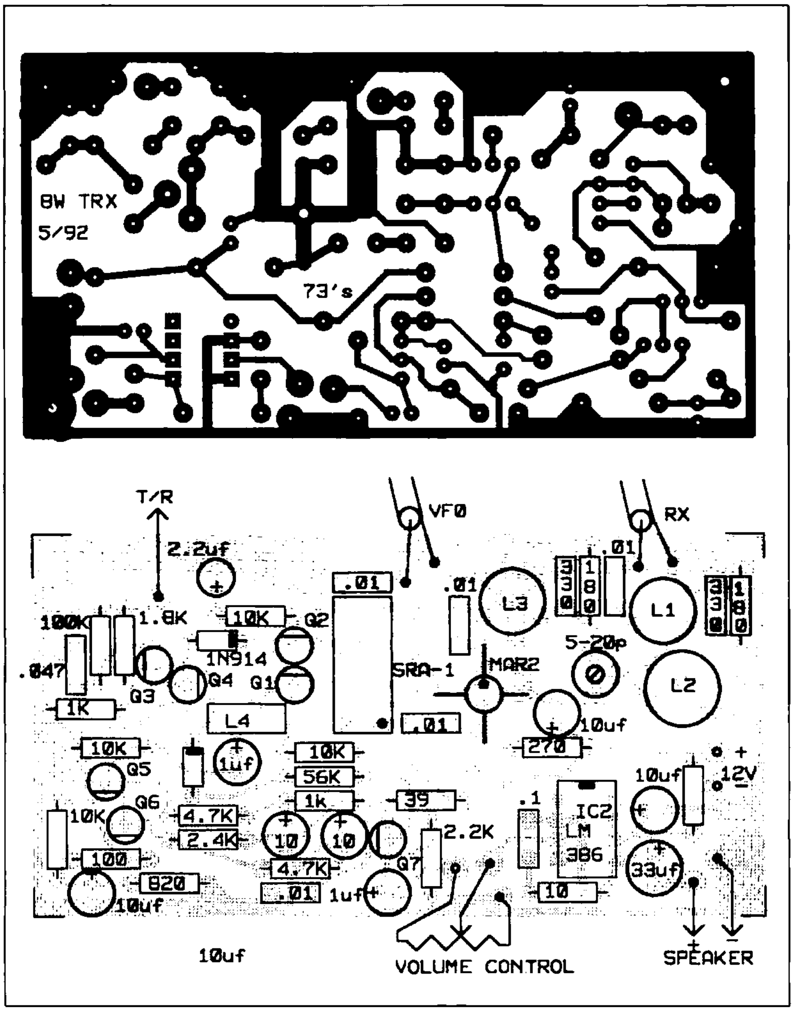


Figure 5. a. PC board foil pattern for the receiver board. b. Parts placement.

help reduce the "thump" problem. From here the audio signal is fed to a high gain preamplifier with Q5, Q6 and Q7 before driving the LM 386 audio power amplifier. These stages are not muted during transmit and the small level sample from the keying sidetone is fed to Q7. The simple sidetone circuit offers a very comfortable tone and is simple to construct. Originally, the bag of transistors I used for Q3 and Q4 were such that I had to play with the value of the Q3 base resistors before it would oscillate.

The VFO board is one where you should consider taking every precaution necessary to eliminate problems. At 14 MHz, VFO drift is more apparent than at 3.5 or 7 MHz. Be sure that you obtain good temperature grade capacitors on the frequency determining LC sections. Glass or silver mica capacitors would be a good choice for the 25 pF values and L4 should be coated with Q-Dope and mounted rigidly. IC3 is an 8-volt regulator and is placed as physically close to the MPF-102 as possible. Q8 and Q9 are 2N2222 transistors used to raise and buffer the VFO output. While you may not have the 10 pF tuning capacitor that I used, anything that you have that will provide the proper range will work. VFO shielding is a must and will get rid of many problems later on.

The switch PCB uses three transistors to handle the keying and T/R line, antenna signal switching to the receiver, and a VFO amplifier which is used to feed the detector as well as to drive the RF amp stages. A diode is used in the collector of Q16 to block or pass the VFO output to the RF amp. The original transceiver used a 1N914, but you may choose to improve this to a better switching type.

When the RF is sent to the PA stages, IC4, Q11 and Q12 raise the signal level enough to drive the MRF-433 final. These are all broadband stages and information is provided later on transformer construction. A low-pass filter will reduce spurious signals on the output.

Table 1. Coil Information

L1, L3	10 turns of #24 wire on Amidon T-37-6 (yellow) toroids. Each coil tapped at center (5T).
L2	38 turns of wire on a single Amidon T-42-6 toroid.
L5	13 turns on Amidon T-42-6 toroid core. Use Q-Dope.
L6,L7	12 Turns #20 wire on Amidon T-50-6 cores.
L4,L8-L11	10 turns of #24 wire on T-37-6 toroid.

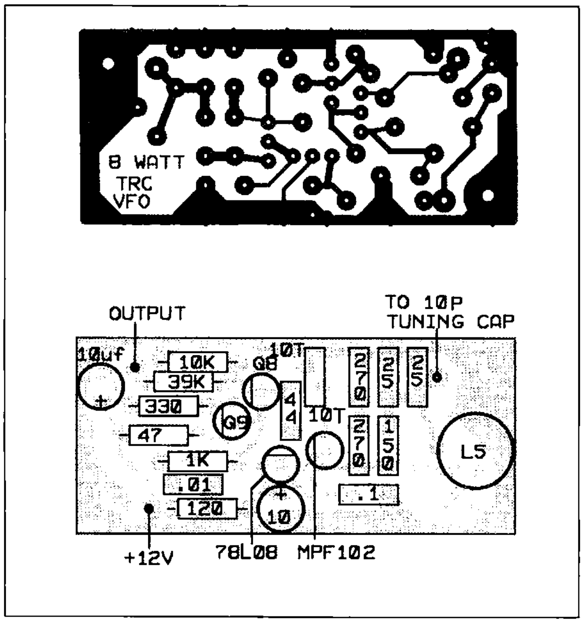


Figure 6. a. PC board foil pattern for the VFO board. b. Parts placement.

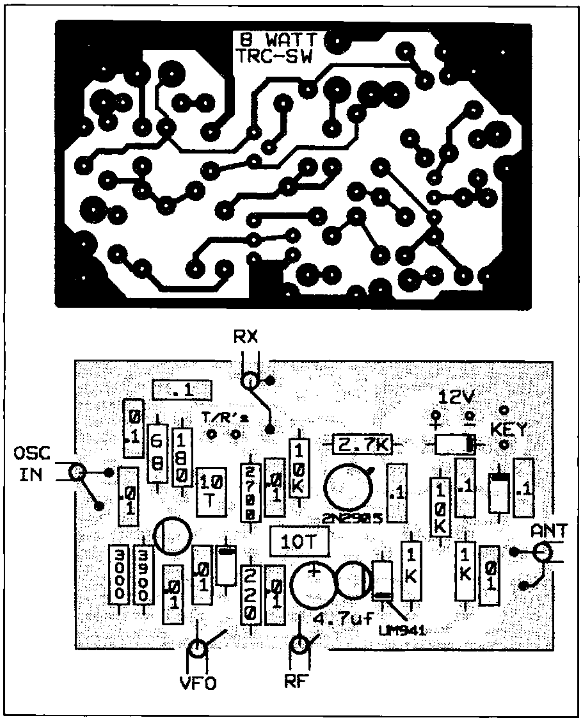


Figure 7. a. PC board foil pattern for the switching board. b. Parts placement.

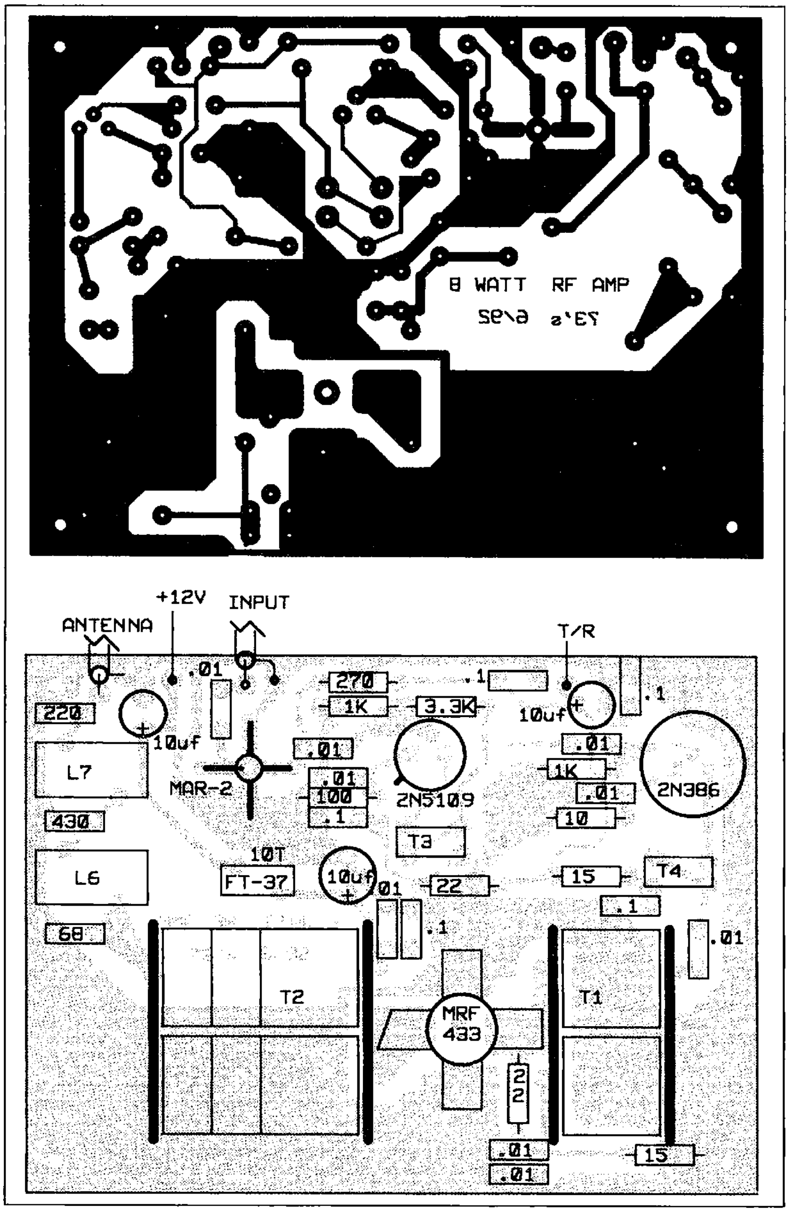


Figure 8. a. PC board foil pattern for the power amplifier board. b. Parts placement.

You may elect to tinker with the input and output transformers so that more output can be realized from the MRF-433. The device has a rated output of 12 watts, and it shouldn't be too difficult to alter this layout.

Construction

This version of the transceiver was mounted in a 2" x 5" x 7" cabinet and there seemed to be plenty of room for everything except the speaker! It was constructed using four circuit boards. The VFO should be separate since it is to be enclosed in its own cabinet. I opted for separating the RF stages because it required a heat sink, but there is no reason you should not combine the switch stage with the receiver. Be sure you connect RF signals from stage to stage with small RG-175 coax cable. The size and type of the T/R and speaker leads is not of much concern. The photographs illustrate the original layout.

Bifilar-wound coils are used at the collectors of Q11 and Q12. Each has 10 turns. T1 is fabricated from brass stock and brass tubing using 2 FT-50 Amidon cores. The tubing represents one turn of wire, and the primary is seven turns of insulated teflon wire. T2 is basically the same as T1, with the exception of using four FT-50 cores. The secondary also contains seven turns for an approximate impedance ratio of 7:1. See Figure 4 for winding details.

Testing and Operation

Initially, use a frequency counter to set the VFO on 20 meters and adjust the bandspread of the tuning capacitor. If you have an oscilloscope, check that the output signal is 2-4V P-P. This signal feeds over to Q16, which is collector-coupled into the detector and the diode switch so there is some mismatch of impedance. Look for a collector signal of 0.5V P-P. This should be all that is necessary for the initial signal. You might want to align the receiver filter next with a signal generator and oscilloscope. The filter itself is about 2-3 MHz wide and, sweeping frequencies across the 20 meter band, you should see a peak at 14 MHz. You shouldn't have any trouble with alignment if it is constructed as shown.

Connecting an antenna to the jack should bring some CW into the speaker. Use a low SWR antenna before actually keying down. The sidetone will be heard as you key, and if you are using an SWR or power meter in line with the antenna, some indication should be seen. You might couple the output with a turn of wire around the antenna lead using the scope probe and monitor the signal. It should be a clean wave with no ugly stuff riding on top. Playing with the values of the low-pass filter may help clear up any junk you might see.

I have used this rig evening after evening, working lots of stations across the country and overseas. You will enjoy using this simple rig much more with an audio filter inserted in the AF chain as the DX pile-ups get hectic at times. My rig was later modified by adding another stage of amplification after the MAR-2. I found that the signals are almost overpowering and the need for AGC arose. California is not the best state to work DX from and the usual weak Europeans still are heard with this rig.

If this is your first home-brew project, you will be delighted with the results and enjoy many hours of QRP operation. This is a basic transceiver and you can add on features to better suit your needs and operation. My antenna is a dipole located in the attic and nothing has been too difficult to work so I am certain your results will be an improvement over mine. ■

Contact Gordon Young WB6NKJ at 305 Los Arbolitos, Oceanside CA 92054.

Table 2. Voltage Chart

		Receive	Transmit
Q11	E	0	2.6
	B	0	2.3
	C	0	11.7
Q12	E	0	0.3
	C	0	11.7
Q13	C	12.7	12.5
IC1	#3	4.7	—
Q5	C	2.0	—
Q6	C	9.3	—
Q14	C	0	12.0
Q15	C	0	11.7

Parts List

Receiver Board

QTY	Description
1	10 ohm resistor
1	22 ohm
1	39 ohm
1	100 ohm
2	180 ohm
1	270 ohm
1	820 ohm
2	1k
1	1.8k
1	2.2k
1	2.4k
2	4.7k
4	10k
1	56k
1	100k
2	330 pF silver mica
4	0.01 µF disc ceramic capacitor
1	0.047 µF disc ceramic
1	0.1 µF disc ceramic
2	1 µF tantalum
1	2.2 µF tantalum
4	10 µF tantalum
1	33 µF tantalum
1	5-20 pF variable capacitor
L1,L3	10 turns (center tapped) on a T-37-6 core
L4	10 turns on a FT-37 core
IC1	MAR-2 MMIC
IC2	LM386 audio amplifier IC
Z1	SRA-1 mixer
Q1-Q7	2N3904 NPN transistors

VFO board

1	47 ohm resistor
1	120 ohm
1	330 ohm
1	1k
1	10k
1	39k
2	25 pF silver mica (or glass) capacitor
1	44 pF silver mica (or glass)
1	150 pF silver mica
2	270 pF silver mica
1	0.01 µF disc ceramic capacitor
1	0.1 µF disc ceramic
2	10 µF tantalum
1	10 pF variable
1	78L08 8-volt regulator
Q8,Q9	2N2222 NPN transistor
Q10	MPF102 FET
L5	13 turns on a T-42-6 toroid
L8	10 turns on a FT-37 core

Switch board

1	68 ohm resistor
1	180 ohm
1	220 ohm
2	1k
2	2.7k
1	3.0k
1	3.9k
2	10k
7	0.01 µF disc ceramic capacitor
3	0.1 µF disc ceramic
1	4.7 µF tantalum
3	1N914 diodes
1	UM9401 diode
1	2N2905 PNP transistor
1	2N5223 NPN transistor
1	2N2222 NPN transistor
L10,L11	10 turns on a FT-37 core

RF Amplifier board

1	10 ohm resistor
1	15 ohm
1	22 ohm
1	100 ohm
1	270 ohm
2	1k
1	3.3k
1	68 µF silver mica capacitor
1	430 pF silver mica
1	220 pF silver mica
8	0.01 µF disc ceramic
4	0.1 µF disc ceramic
3	10 µF tantalum
L6,L7	12 turns on a T-50-6 core
L9	10 turns on a T-37-6 core
T1,T2	See Figure 4
T3,T4	10 turns bifilar wound on an FT-37 core
1	MAR-2 MMIC amplifier
1	2N5109 transistor
1	2N3866 transistor
1	MRF433 power transistor

Note: Blank PC boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. Price: receiver board: $4; switch board: $3.50; RF board: $5.25; VFO board: $3; all four boards: $13. Please add $1.50 shipping per order.

VE3CYC's Wire Beam

Continued from page 18

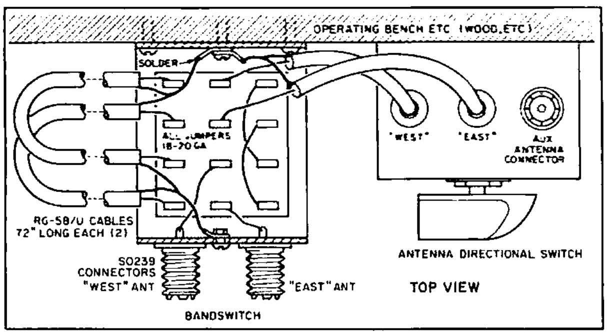


Figure 6. Top view of the switching arrangement to achieve maximum front-to-back performance and to switch directions of the beam. Make sure you don't mount the switches on any metal surface that connects to your station ground.

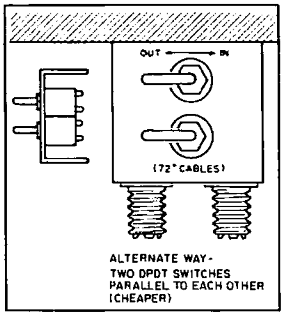


Figure 7. Using two DPDT switches to simulate a 4PDT switch. Make sure you throw both switches in the same direction during use.

everything was still working fine, I proceeded to make an identical twin of the same antenna, including the exact same length of feedline. I used spreaders to keep both antennas exactly 10 feet apart. I chose that distance on purpose because it is roughly 0.15 wavelength on 20 meters, and 0.225 wavelength on 15 meters. This would give me a wide range of gain and maximum front-to-back ratio over most of the 20 and 15 meter bands, with an input impedance of 50 ohms on 21.2 MHz and 20 ohms on 14.15 MHz (more about this later).

The two spreaders I used were made from seven feet of aluminum tubing, with hardwood dowels hammered into the ends and screws added to keep them in place, to make the total length of the spreaders 10 feet. (See Figure 2, and details A, B, C and D.)

The tubing I used was only 5/8" o.d. of soft aluminum, which turned out to be a disaster later on—during high winds they started to bend. I corrected this by making reinforcements (see Figure 3). I would highly advise you to use a heavier wall aluminum, or a larger diameter. You could use 10 feet of tubing as long as you keep it at least some distance away from the ends of the 20 meter insulators (mine turned out to be 21"). In case you do not need the reinforcements shown in Figure 3, have a look at detail D.

Burn the ends of the nylon ropes to prevent unraveling, and use plastic cement on the knots to prevent them from slipping loose in the future. Solder the wires to the feedline right away, and cover them with shrink tubing. You should wait for a few weeks of rough weather, in case the wires stretch and you have to make them shorter, before you solder them permanently at the ends of the dipoles and cover them with shrink tubing. I used a heat gun for my shrink tubing, but you could use a cigarette lighter. If you have trouble soldering the wires, use Acid-core solder. It does wonders on old, corroded wiring. Just make sure you wash all the acid residue off before covering the connections with shrink tubing. I have also used silicon rubber to seal off and keep things in place.

It might not be such a bad idea to make each leg a few inches longer than I have specified. You can then adjust them for the lowest SWR yourself, and cut the excessive length off later on when you are completely finished. Always start by adjusting the lowest frequency antenna first, then work up from there. Each feedline, including the length of the cable used in the coaxial choke just below the antennas and the PL-259 connectors, was 56 feet long at this point.

The Big Letdown

Now I was ready for my great experiment. All I had to do was hook up one feedline, which I will call "east," to my antenna switch, hang a hunk of coil to the other feedline, and...BINGO! I should be able to wake up every ham in Europe.

Boy, was I in for a disappointment. After spending several hours monkeying around with all kinds of combinations of inductors and wires at the end of that unused feedline to make its antenna act like a reflector, the best I could get was a front-to-back ratio of less then 6 dB. I gave up in disgust. I couldn't figure out what the hams in those articles were bragging about.

I yanked off all the wires and coils that I had previously hooked up to the end of that open feedline. All that work for nothing.

The Supreme Beam

Then, while that feedline was hanging there dangling, Europe came in like gangbusters. I could not believe my ears. All of a sudden I had the directional gain I've been after all along. I rapidly hooked both feedlines up to a two-pole antenna switch. And now, by switching between east and west, I really noticed a fair amount of gain in both directions.

After tuning up on 15 meters I had the same experience, but even better. I followed this up by making a few contacts, and the response was good. They all agreed that my antenna was definitely performing like a good beam should. That sure made my day—at least I was up to something good. Now I wondered what made it tick.

What Makes It Work?

The first thought that came to mind was: Since the feedline had a capacity of 28 pF per foot, and I had 56 feet of it, the answer must be there. I had about 1568 pF in series with both legs of my dipoles. (Later on in this article the feedlines will only be 54 feet long.)

This could lower the resonant frequency enough to make the dipoles, which were not connected inside my antenna switch, behave like reflectors. I also realized the theory of quarter wavelengths of feedline, or odd multiples of it, acting like impedance transformers. For example: If you take a piece of 50 ohm coaxial cable, and you cut off 0.25, 0.75, 1.25, or 1.75, etc., times the wavelength of that cable (using the formula for quarter-wave transformers or odd multiples), you will have an impedance transformer.

To put it another way: If I would hook a 25 ohm composite resistor up to one side of this cut-off piece of that feedline, the other side would see 75 ohms. This also means that if I would leave one side completely open, the other side would act like it was completely closed. This would, for all intents and purposes, connect the two halves of each set of dipoles together and make them act like reflectors. And, of course, by carefully manipulating the length of feedline, you get various degrees between completely open or closed conditions.

I am not able to explain mathematically what makes this possible. All I can say is that it works, and it works quit well. I personally feel that the principles of operation are primarily based on a combination of the two theories I have just mentioned: the odd multiple of quarter wavelengths, in combination with the capacitance of the feedline.

Some Arithmetic

According to the formula for a quarter wavelength of feedline (246/frequency in MHz x 0.66); 0.25 wavelength of RG-58/U turns out to be 137.7" for 14.15 MHz, and 91.8" for 21.2 MHz. This means that 1.25 wavelengths of this feedline for 14.15 MHz (5 x 137.7") is 688.5", and 1.75 wavelengths for 21.2 MHz (7 x 91.8") is 642.6".

Now, if you look at the total length of feedline which I am using for 20 meters (54 ft. x 12), which is 648", plus 72" as part of the bandswitch, plus 9" around the bandswitch, you get a total (648" + 72" + 9") of 729".

Then, comparing it to the actual feedline, we are out (729"-688.5") by 40.5" on the 20 meter band. And on the 15 meter band (648" + 9" = 657") it differs from the actual feedline (657"-642.6") by 14.4".

Bad Weather Leading to More Improvements

Now back to business. I experienced a lot of problems on windy days because of the way the 15 meter dipoles were hanging below the 20 meter dipoles. They kept moving toward and away from each other. As a result, the SWR meter went crazy. I took the whole system down and rearranged it the way you see it in Figures 4 and 5 and details A, B, C and D. It made the Wire Beam much more stable.

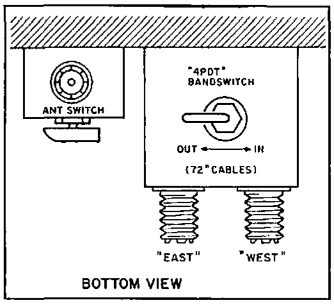


Figure 8. Bottom view of the switching arrangement using a 4PDT band switch.

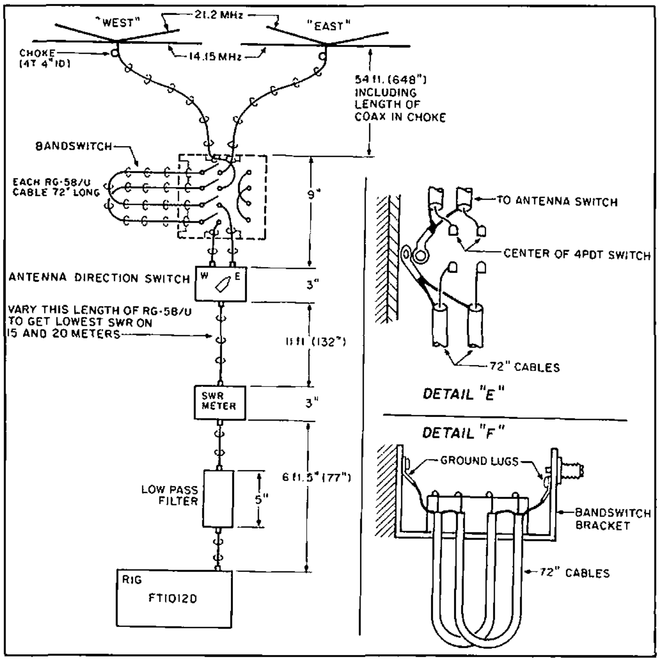


Figure 9. Wiring diagram of the complete wire beam system.

You'll notice the stabilizing ropes in Figure 5 and in the photographs. They are attached to the poles (towers), depending on what you use. This will add in stability on windy days. This is very important for withstanding extreme weather conditions.

Here in Canada, where I live, we get some pretty rough weather sometimes. My Wire Beam has survived 80-miles-per-hour gales, together with blizzards, after first being covered with ice from freezing rain.

Some Fine Tuning

Now that the beam worked, I started doing some fine tuning. I trimmed both feedlines to 54 feet (as mentioned earlier), including the PL-259 connectors. This was done with a switching arrangement, which puts an additional 9" in series with each feedline (I will explain this later in the article).

So, if you feel that you don't want to go into the complexity of an elaborate switching system to be able to switch bands, make your feedlines 54' 9" long. Then you can use the beam on 15 meters as it is. If you want to go on 20 meters, all you have to do is add an extra length of feedline, 72", to each of your incoming feedlines. Now you can work 20 meters and, as you will see later, 10 meters as a bonus. Without the 72" extensions you can work 15 meters, as well as 12 and 17 meters.

Bandswitch Construction

Should you decide to go all the way, you will have to make a bandswitch like I did. Take a good look at Figures 6, 7, and 8, as well at details E and F. Follow my drawings exactly, keep all wires as short as possible, and do not use more than 6" of coaxial cable between the bandswitch and the antenna switch. And don't forget to make all the ground connections exactly the way I marked them off in my drawings. They are extremely important for the beam to work successfully. Don't forget that your feedline should only be 54' (instead of 54' plus 9").

In my bandswitch, I have used a four-pole, double-throw (4PDT) toggle switch, which is a bit expensive and hard to get. If you can get one cheap, consider yourself very lucky. Otherwise, as an alternative you could use two ordinary double-pole, double-throw (DPDT) switches and put them side by side. You could even solder the levers together with a strip of metal, as long as you switch them both together every time. These DPDT toggle switches are a lot cheaper, and readily available. Look for Radio Shack #275-1533 or equivalent.

Now you have to make a "U" bracket for the bandswitch. I used aluminum because it is easy to work with. You have to drill the mounting holes, switch holes, and holes for two SO-239 connectors. Mount everything according to Figures 6 and 7, and details E and F. Keep all wires as short as possible.

All coaxial cables should be RG-58/U or equivalent (the velocity factor of 0.66 is important here). Wrap and solder all coaxial braiding to each other (as illustrated) and the ground lugs (as in details E and F). Use a pair of pliers as a heat sink while you do that, and solder the inner conductors last, after everything has cooled down.

The Antenna Switch

For an antenna switch, you could buy one or make your own. You could use a simple two-way switch, "east" and "west." Or you could do what I did—add an extra SO-239 connector for any future antennas, and have a fourth position to switch all antennas off, as well as grounding the cable which comes from your station (in case of thunderstorm activity).

A Word of Caution

DO NOT MOUNT THE BANDSWITCH OR THE ANTENNA SWITCH ON ANYTHING CONNECTED TO YOUR STATION GROUND. Use only the grounds on the coaxial cables. Don't forget—both switches are now a continuation of your antenna system. Any additional grounds will upset the delicate balance of the system. Mount the bandswitch and the antenna switch as close to each other as possible, and mount them on insulating material, like your station's desk, bench or table.

I mounted my bandswitch with the switch lever facing down, but you might prefer it with the lever facing upwards. That might make it easier to manipulate.

How to Use the Bandswitch

Table 1 shows you to which side to move the lever (or levers) of the bandswitch to get maximum front-to-back ratios on each band. Don't forget—the switch will toggle just opposite of what you might expect. For instance, away from the 72" coaxial cables to switch "in" the coaxial cables, which you need for 20 meters, etc.; and vice versa on the other bands, except 10 meters, which will be the same as 20 meters.

Figure 9 shows how everything is hooked up in my station. The dimensions of all the components involved are important, as are the lengths of all coaxial cables, which include all necessary connectors. This information might come in handy should you run into problems such as excessive SWR readings.

SWR Curves and Some Afterthoughts

I found that I had to do some juggling with cable lengths to get my SWR as low as possible on 20 and 15 meters. I did all my trimming with the cable between my SWR bridge and the antenna switch.

Remember, this beam was primarily designed for 20 and 15 meters, so don't be too critical about high SWR on any other band besides these two. The fact that it worked like a normal beam on 10 and 12 meters surprised even me. I think that this is because the 20 meter reflector might act like two half-wave elements, side by side on 10 and 12 meters, although the driven element is not resonant at these frequencies and probably not too efficient. That is why the SWR readings on these bands are so high.

But who cares? With an antenna tuner you can make the SWR flat, just like with all the other all-banders. On 17 meters its performance is nothing to write home about. It has a slight bit of front-to-back ratio, 6 dB at the most, but hey, it's better than nothing.

No More Worries

There are some extra advantages to this antenna. You have less to worry about when it comes to burglars. They have no idea that you are a ham, and hopefully they do not assume that you have a lot of money tied up in equipment. They most likely think that the Wire Beam is just a receiving antenna, and

Band	Bandswitch	Position
20m	72" Extension	switched in
17m	72" Extension	switched out
15m	72" Extension	switched out
12m	72" Extension	switched out
10m	72" Extension	switched in

Table 1. Bandswitch positions.

Band	My S-Meter (avg.)	Their S-Meter (avg.)	Their Min.	Their Max.
20	3.3 S-units	3.0 S-units	2.0 S-units.	4.0 S-units
17	1.0 S-units	0.0 S-units	0.0 S-units	0.5 S-units
15	5.0 S-units	3.5 S-units	2.0 S-units	6.0 S-units
12	2.3 S-units	2.2 S-units	1.5 S-units	3.0 S-units
10	2.8 S-units	2.3 S-units	1.0 S-units	5.0 S-units

Table 2. Average front-to-back ratios on my S-meter vs. distant station's report.

they have not much to gain by breaking in.

Also, when the weatherman forecasts a hurricane, or you go on vacation, you can just lower your beam and let it lay on the ground; then nobody can see it.

Performance

I have been on the air with this beam for a great many hours, and worked all over the world with it. The reports were usually very good. Although it is only a two-element beam, it often behaves like a three-element yagi. I confirmed this by comparing it with nearby hams who were using regular three-element tribanders. Most distant stations could not hear the difference. Sometimes mine came out better.

I must add that my beam is actually aiming about 48 degrees east of north, and in the other direction, of course, 48 degrees west of south. Thus I favor Europe and Asia one way, and California, Mexico and Australia the other way. Since it only takes a split second to change direction I often fool people by switching back and forward. Many people then tell me that I disappeared completely, while a moment before they had given me a Q5 and S7.

Because of the wide lobes associated with two-element beams, I usually had no problems working any station I heard. This is not the same with multi-element monobanders, where you have to keep one hand on your rotator control box when you are in a round table. I can rotate my beam 180 degrees every second, while people with rotators can only do this twice a minute. And look at the price of a commercial beam plus rotator—you're talking about big bucks there. Compared to that cost, the price for buying all the material needed for this beam would leave you enough extra money to buy yourself a dual-bander mobile rig for VHF and UHF, with an antenna and all accessories included.

A Ham's Dream Come True

I have compiled many signal reports over the last several months, and took the average front-to-back ratio reports of stations worked from all over the world. I used information from my S-meter, and from what other hams reported to me from carefully observing their own S-meters. I usually put my FT-101 ZD in the "tune" position so their S-meters would be steady. I wrote all the front-to-back readings down at the time.

Table 2 shows the average front-to-back ratios for each band. I compiled this information by observing my own S-meter and using the reports of the hams I worked, who were observing their own S-meters. I have always made sure that I only observed signals which I received direct, from either the front or back of my beam. The minimum readings might have been a result of multipath, of reflections of objects, or of atmospheric conditions.

Don't forget, when I say minimum readings, I do not mean low readings. Most of the time I had to use my attenuator. Some hams did not quite understand what I was after, and as a result would say things like: "You go from S9 to 20 dB over S9," so in a lot of cases I had to draw my own conclusions.

The highest front-to-back readings that I observed on my own S-meter went as high as 5 S-units on 20 meters, 7 S-units on 15 meters, 4 S-units on 10 meters, and 4 S-units on 12 meters. And this happened quite frequently.

I worked at least 10 stations on each of these bands, mostly from Europe and the western United States. And I listened to many more to arrive at the average of these figures. I haven't got a clue what the gain over a dipole is because I had nothing to compare it with. I am inclined to think that it is better than a conventional multiband two-element beam, because of the absence of traps.

For the Experimental Types

One could easily duplicate this beam for other frequencies, or even add more frequencies, by adding spreaders at right angles to the original ones. I gave you all the ideas, now just start working on it. How about a similar beam on 80 and 40 meters? Or trying this beam in an inverted "V" arrangement?

According to some empirical calculations I've made, a good starting constant would be about 1.14. For instance, if you figure out the length of the feedlines needed (considering what I have said before about odd multiples of quarter wavelengths), you can multiply these calculated lengths by 1.14 to get the interacting capacitive reactances to make this Wire Beam possible. You will than be in the ballpark to start your trimming.

If you run into problems understanding what I am trying to get across to you, please refer to the many good books on the subject available to radio amateurs. You can start with the ARRL publications, such as the *Radio Amateurs Handbook* and *The ARRL Antenna Book*. And, of course, there are many more. Look for "Uncle Wayne's Bookshelf" in *73 Amateur Radio Today*.

For those of you who do understand, this might just give you some ideas that you have been waiting for. I have tumbled into some principles I was not aware of before. I hope that many of you will take advantage of it, and even build on it. Some day I might see one of your articles in a popular ham magazine, like this type of beam for 160. I don't have the space, otherwise I would try it myself. Good luck!

73 Review

by Bill Brown WB8ELK

The j•Com Ventriloquist™

j•Com
P.O. Box 194-T
Ben Lomond CA 95005
(408) 335-9120
Fax: (408) 335-9121
Price Class: $125 w/o case
$150 with case

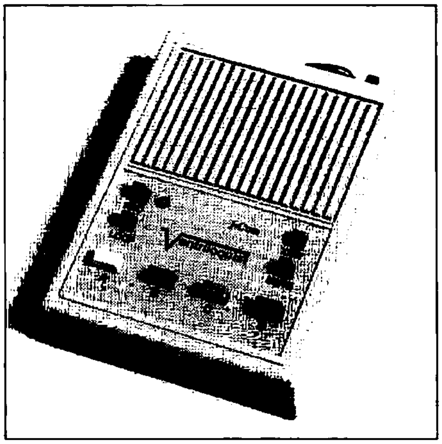


Photo. The j•Com Ventriloquist can store four independant voice messages.

Last year a company called Information Storage Devices introduced a series of new ICs that seemed to be custom-tailored for amateur radio use. One of these chips, the ISD1020, is capable of storing 20 seconds of high-quality voice and instantly playing it back without the usual conversion between the analog and digital worlds. In addition, they designed the chip so that the starting point of any message can be digitally controlled. This chip virtually cried out for someone to turn it into an extremely useful ham radio accessory.

The Ventriloquist

Well, the folks at j•Com have done just that. The Ventriloquist is a device that can store four variable length voice messages. You can play them back individually with the press of a button. Since the ISD chip is based on EEPROM technology, you can completely remove power from the Ventriloquist and it will retain the messages you've recorded for up to 10 years!

Save Your Voice

Anyone who participates in a lot of contesting or likes to chase DX will love the rest that the Ventriloquist will give your vocal chords. For example, you could record "CQ Contest this is——" in message A; "You're 59, 1-Alpha" in message B; "QTH is New Hampshire" in message C and any other information you'd like to convey in message D. You could operate most of the contest with just a few presses of the appropriate buttons.

The Ventriloquist even has a LOOP switch which will play back message B in a continuous loop. This is useful for long CQs or possibly even a beacon for foxhunting or as a test signal for you workbench.

In order to make the most out of the limited recording space in the ISD1020, the Ventriloquist has a series of DIP switches that can individually partition the amount of recording space for each message.

Getting the Word Out

The Ventriloquist has a PTT (Push-To-Talk) output line that can key a transmitter. The audio output level is reduced to the level that your transmitter wants to see at its microphone input through an onboard potentiometer (R50) adjustment. In addition, the Ventriloquist has a built-in speaker so you can listen to the outgoing message. There is a MUTE switch to bypass this feature if so desired.

There is a multi-pin jack on the back of the Ventriloquist for power, audio in/out, PTT out and remote control of the message switches. This allows you to interface the Ventriloquist up to the parallel port of your home computer and actually have a program select and activate the messages. For example, the popular contesting program "CT" has an output capable of activating the Ventriloquist as well as other voice devices.

One feature that has great potential is the capability of recording external audio inputs via the AUDIO IN pin. You could tap into your rig's speaker output (you will need to reduce the audio level through an external potentiometer), record the signal from the station you're working and instantly play back their voice as you've received it. This line parallels the internal electret microphone, however there is a jumper in the REV. 1 version of the board that will allow you to bypass it.

Impressions

The audio quality of the Ventriloquist is impressive. However, on higher pitched voices you may notice some slight distortion. This is due to the 2.7 kHz bandwidth of the ISD1020 chip. If you desire higher bandwidth capabilities, you could replace the ISD1020 with the ISD1016 (16 seconds with 3.4 kHz bandwidth) or the ISD1012 (12 seconds with 4.5 kHz bandwidth). However, unless you're after the ultimate in high-fidelity, you won't notice the difference after running it through an SSB transceiver.

Operation of the Ventriloquist is easy. Just push the RECORD switch down, followed by the message button where you want your message to reside. A red LED lights up whenever you're in RECORD mode. On the REV. 1 version of the board, this LED turns green in PLAYBACK mode.

When recording your messages, take care not to talk past the time limit of each message area. Otherwise the "End of Message" bit doesn't get recorded and your playback may include two or more messages.

Message D is played whenever the Ventriloquist is powered up. The folks at j•Com even stored a message at this location that advises you to consult the manual. Of course, you can record over it, but it was a nice touch to have it talk to me the first time I turned it on! If you have the companion enclosure, the audio level from the speaker is more than adequate. However, it will be on the low side if you don't put it in an appropriate enclosure.

The current drain is around 30 milliamps on standby and only 50 milliamps when it talks. As a result, you can operate for some time using just a small battery. Although the Ventriloquist was designed for a 12-volt supply, it will operate from 9 to 16 volts.

Ins and Outs

Since there are so many different types of microphone plugs on amateur transceivers, it's difficult to design a universal interface to hook up the audio output and PTT lines to the transceiver. As it stands, this part of it is left up to the individual user. I just paralleled the audio and PTT lines across my microphone, but this entailed modifying my microphone's plug. It would've been nice to have an adapter to go between the microphone and the rig. Some rigs have an accessory jack that makes the interface easy, however.

The manual shows how to lower an external audio input (via an external potentiometer and capacitor) so that it can be recorded by the Ventriloquist via the microphone input pin. Although it was easy to wire a pot and capacitor in-line, it would've been nice to have this potentiometer built right on the board.

Once I had everything hooked up, I thoroughly the enjoyed the ease of operation that the Ventriloquist provided. It takes up very little space and is a very easy to operate. It certainly is great to throw your voice around the world at the push of a button.

Number 9 on your Feedback card

73 Review

by Mike Baker W8CM

Heights Tower Systems
1721 Indian Road
Lapeer MI 48446
Telephone: (313) 667-1700
Price: Call for price quote.

The Heights Tower Systems Aluminum Tower

Hang your aluminum on some aluminum.

As soon as I moved from West Texas to Virginia, I noticed that the trees here were much higher, and the tower I brought with me just would not put the antennas where they needed to be. Since I found myself in the market for a taller tower, I took advantage of an opportunity to visit the factory of Heights Tower Systems in Lapeer, Michigan, and meet Drake Dimitry Jr., its president. I had long been interested in having an aluminum tower due to their inherent lower weight and freedom from rust. The quality materials, good workmanship, and exceptional customer responsiveness I found at Heights convinced me that my next tower would come from this company.

The Heights Tower

Heights has been around since 1959, and presently offers aluminum towers that are self-supporting up to 144'. Greater tower heights can be achieved by using guys. The unguyed tower height you can have depends on how much antenna you plan to plant on top, measured in "square feet (SF)" of wind loading near 80 mph. For 144', the maximum is 8SF, while at 80' you can use up to 38SF and still be self-supporting. The actual tower height and loading are designed by selecting a combination of tower sections that come in 8'-long pieces. Tower section face widths currently range from 35" to 11". Heights does not endorse using more than three sections (24') of any particular width before tapering to the next width. The combination of tower section face widths and tapered design give the tower its strength.

While this review will focus only on the Heights tower with tapered sections and a hinged base, it is interesting to note that the company also can provide other types. You can get a crank-up telescoping unit in up to 34 variations, or you could opt to use a foldover kit on the tapered model, with or without the standard hinged base.

For my new QTH, I selected an 88' tower rated at 22SF. This model consists of three 30" sections, three 26" sections, three 22" sections, and two 18 " sections. This is a pretty substantial tower, and you can be prepared to pay more for an aluminum tower than for a steel unit. I felt it was worth the higher initial price to achieve the long life and low maintenance of aluminum. Also, my experience with guyed towers has taught me that considerable work and expense goes into the guy system; this is often overlooked in comparisons of towers. Finally, ask your local metallurgical engineer about how steel sections snap but aluminum sections bend when they fail.

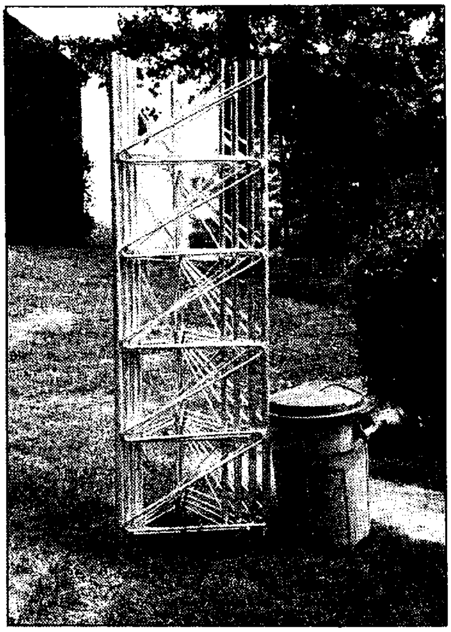


Photo A. Heights Tower sections.

The sections come from Heights nestled into bundles, as shown in Photo A. I had expected to receive 11 separate tower sections off the truck at delivery, but instead only three bundles were off-loaded. This makes it easier to ship, and protects the inner tower sections. I did have one outer section get bent in shipment by the freight company where a bundle was obviously dropped on its end. A lesson learned: Trucking companies are totally unfriendly about damage claims unless you inspect the shipment and note any damage at the time of delivery. Calling them the next day will not work. As a result of this problem, Heights has changed its trucking company and has also designed a brace to protect the outer section while in shipment. This was one of many instances where Heights was highly responsive to customer input. (Be sure to ask them to brace your order for shipment.) The sections come in either straight, tapered, or top designs. For example, my first three sections consist of two straight 30" units and a 30" taper unit to transition to the next 26" straight section. As you can also see in Photo A, the tower sections all use a "Z" brace. This makes climbing very easy and "foot friendly," compared to the bracing used by several other tower manufacturers. Tower section sizes and data are given in Table 1. The tower sections are double-bolted together with steel hardware; you can also order a hardware upgrade from Heights which provides stainless steel nuts and bolts. I used all stainless steel hardware, and highly recommend this option. After all, why buy a rust-free tower and build it with nuts and bolts that can rust? After swallowing the initial cost of the tower, this upgrade is really a minimal cost option.

The supplied tower hinged base gives you the option of either building the tower on the ground and hinging it up, or building it section by section. The hinged base assembly is available in either heavy-duty steel or in stainless steel. I chose the stainless steel, and felt the slight additional cost was well worth it. Heights does not provide the hinged base in aluminum in order to avoid corrosive effects; concrete and aluminum do not like each other.

With the base also comes a set of three very hefty steel legs for setting into the concrete pad. The legs come with disks welded on to increase their anchoring ability in the concrete. The legs are not hot-dip galvanized, so you will need to spray a cold galvanizing onto the exposed leg parts after the tower is installed.

I decided that since the base legs are hollow, I wanted to provide a drainage path to protect against freezing. Each leg bottom goes into a 4" plastic drainage pipe which is used as a form and is filled with pea gravel to above the bottom of the leg. Photo B shows the hinged base and leg top after the concrete base pad is completed, but before applying the cold galvanizing.

I did not buy a top section with a mast collar tube section; instead, I used a standard straight section at the top with a top shelf. Heights offers both top shelves and rotor shelves, and will obligingly custom drill them for your bearing and rotor if you provide the data with the order. You can also obtain a variety of aluminum mast from Heights; I bought a 16' long piece of 2" o.d. tubing with a 1/4" wall thickness with my tower, since it could be included with the freight charges and tower.

Photo C shows the top shelf on the 18" top section. Heights originally provided a top shelf that was built similar to a rotor shelf and used a single bolt in each leg. After conferring with them, I specified a design which covered the tower legs and used two bolts in each leg. When they promptly made the new top shelf, they also drilled it for the thrust bearing I

planned to use. This top shelf is now their standard design.

At the time of my order, Heights could not provide a sufficiently heavy-duty thrust bearing, so I obtained a Rohn TB3 from a dealer and sent it to Heights for their top shelf drilling. Heights can now supply several very nice thrust bearings. Incidentally, thrust bearing eagle-eyes will note four extra bolts on this bearing. These are temporarily inserted as my own modification to prevent antenna rotation while performing maintenance on the rotor; thrust bearings do a wonderful job of turning in the wind when you do not have the mast clamped in the rotor. When you specify the top shelf drilling to Heights and are planning to use a thrust bearing with a 2" mast, I recommend having them drill the top shelf hole 2-1/4" in diameter to allow for alignment and to let the thrust bearing decide the mast center above the rotor. Heights was very cooperative and responsive to my needs for both the top shelf and a rotor shelf that needed non-standard holes. Of course, the hardware is available in optional stainless steel, including the U-bolts for the rotor shelf.

Making the Concrete Base

If you've never done a self-supporting tower before, you are in for a big surprise when it comes to preparing the concrete base. The base provides all the strength for a self-supporting tower, and it must be done right. For my tower, Heights recommended at least a hole 5' x 5' x 5', and needing 4.6 cubic yards of concrete. I usually do things a bit conservatively, and my base hole was bigger: I poured seven cubic yards. After hearing the outlandish quotes from several local concrete contractors, I went ahead and did the entire project myself at about half the cost. Digging the hole takes a lot of work when using a shovel and wheelbarrow, so don't rush yourself.

After the hole is ready for swimmers, a reinforcing steel bar cage is needed. I've never seen anything harder to cut than those bars! Carbide hacksaw blades bounce off alloy steel bars, so have several blades ready. Keep the rebar at least several inches away from the tower legs to keep lightning from fracturing the base and then dropping your tower.

I did not think I could do the job myself at first, but taking things carefully one at a time without rushing did finally result in a level, framed form ready for pouring. I do recommend buying the special framing nails for your lumber forms, along with the framing stakes from the local hardware store. The tower will be level if you prepare the base legs with the first tower section attached, and temporarily guy this section. Guying an 8' tower may sound silly, but the last thing you want is for those seven yards of wet, heavy new concrete to move the legs or tower out of alignment when the concrete is being poured into the hole.

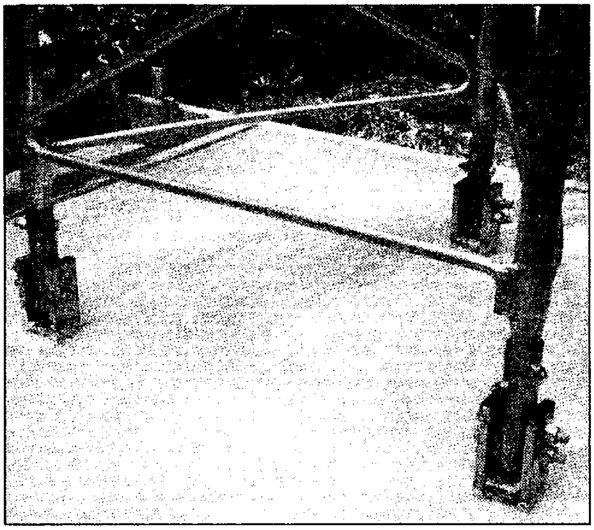


Photo B. Hinged base.

Photo D shows the formed base ready to pour the concrete. Note that you will have to shore up the first tower section with some lumber to keep the base legs at the proper height. I recommend using a 1" x 2" piece atop each form top and below the shoring lumber to allow access to the freshly poured concrete when you want to finish the top concrete surface.

Proper grounding of the tower is done by running #4 gauge solid copper wire from each leg to three ground rods 8' long and 5/8" thick about a foot out from the concrete, then connecting each ground rod to each other and to the shack ground. The tower legs needed larger ground clamps than the local hardware store could supply, but I found that the Polyphasor Model J-2 clamps could fit easily. Be sure to make no sharp bends in any ground wire; lightning follows a straight line and does not like curves. I definitely do not advise skimping on materials here; your grounding system is vital to the health of the tower, antennas, radios, and your house.

Final Construction

Now that you've paid for the tower, dug the hole, paid for the concrete, installed the ground system and rested—you can build the tower. I did it section by section instead of hinging the tower up from the ground. My biggest shock came when I went to use my trusty Rohn gin pole. Guess what? The Heights tower tubular legs are a lot bigger than either Rohn 25 or 45 tower legs, and my gin pole clamp would not fit. Here's where the low weight came in very handy. My-13-year-old son (N8QER) and I simply pulled each section up by hand with a rope, then planted the new section on the one below. Even the biggest 30" sections weighed only 45 pounds, compared to a higher steel tower section. Also, the 8' section length was much easier to handle than a 10' section would have been. Of course, the use of a quality safety belt by each tower worker is absolutely necessary. By the way, don't underestimate the amount of

Continued on page 61

Table One

Face Width	35"	30"	26"	22"	18"	14"	11"
Section Weight:	63 lbs.	45 lbs.	36 lbs.	30 lbs.	21 lbs.	14 lbs.	11 lbs.
Leg Diameter:	1.708"	1.625	1.5625	1.500	1.3125	1.0625	1.0625
Leg thickness:	0.204"	0.162	0.131	0.100	0.114	0.0962	0.0962
Z-Brace thickness:	5/8" solid	5/8" solid	9/16" solid	1/2" solid	7/16" solid	3/8" solid	3/8" solid

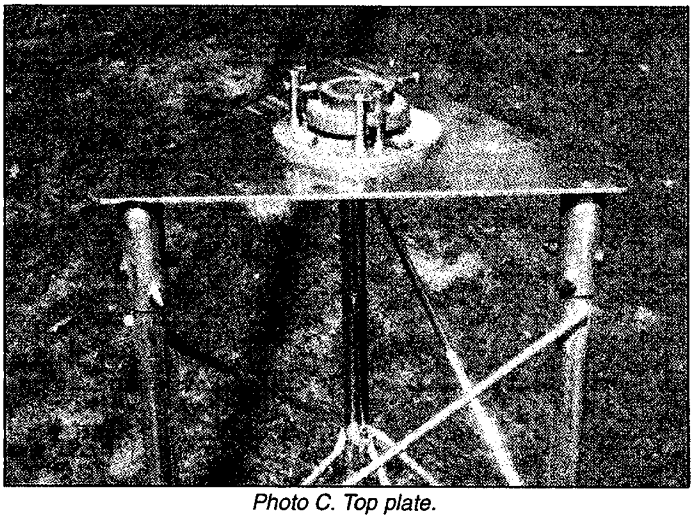


Photo C. Top plate.

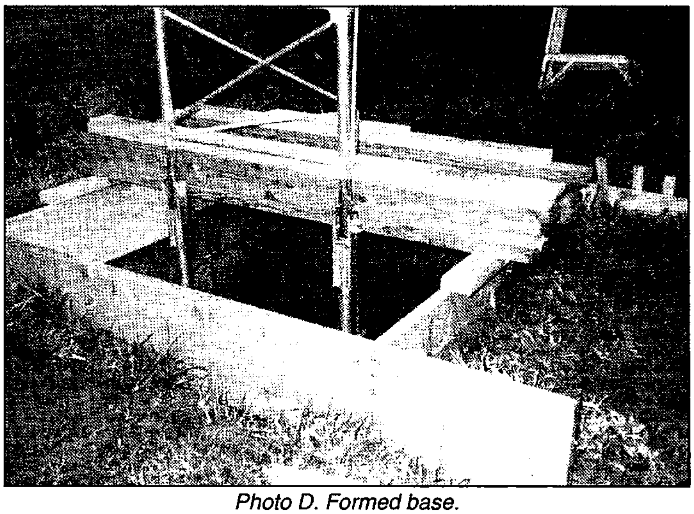


Photo D. Formed base.

HAMSATS

Number 10 on your Feedback

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

SAREX Activity on STS-45

The Shuttle Amateur Radio Experiment (SAREX) activity on STS-45 lived up to its billing as a more informal operation with time for unscheduled 2 meter contacts with hams on earth. Most of the activity during the early days of the mission was dominated by school contacts, but after successfully completing many scheduled QSOs, the last days provided many with a chance for an informal quick contact.

The shuttle *Atlantis* was used for the ATLAS-1 (Atmospheric Laboratory and Applied Sciences) mission. Four of the seven astronauts of STS-45 were hams. The most heard callsign was that of mission specialist Dave Leestma N5WQC. Kathy Sullivan N5YYV was quite active with ham activity toward the end of the flight using Dave's call on a downlink of 145.55 MHz. Pilot Brian Duffy N5WQW and payload specialist Dirk Frimout ON1AFD were also monitored on 2 meters. When making private or school contacts on unpublished downlink frequencies, the astronaut-hams used their own calls, but primarily employed Dave's on 145.55 MHz. Future missions will use the call W5RRR/S to avoid callsign usage questions.

QSLs for STS-45 reception reports or contacts should be sent to the Sterling Park Amateur Radio Club, P. O. Box 599, Sterling VA 22170. Include a business-size envelope (or larger) with your QSL. Be sure to note the date, time and signal report on the card. Write on the outside of your envelope "STS-45 QSL 2-way" for QSO confirmation or "STS-45 SWL" for signal report confirmation.

The Poor Man's Satellite

Amateur television activity via balloon has been featured several times in the "ATV" column and other articles in *73*. Although balloons are a great way to get television signals out to more observers, they also provide an opportunity to try telemetry systems and communication experiments.

OSCAR-1 went into orbit over 30 years ago. It sent the message "HI" in Morse code at a speed related to the temperature of the on-board electronics using a 140 mW 145 MHz transmitter and a non-rechargeable battery. It lasted for a few weeks until its reentry.

Using the idea of OSCAR-1 as a guide and inspiration, the South Texas Balloon Launch Team sent a ham radio package to over 100,000 feet in late 1990. The FM transmitter was crystal controlled, with 100 mW output on 2 meters. A simple CW message generator with an analog signal mutiplexer sent tones representing the outside temperature and atmospheric pressure along with an identifying callsign. The speed of the code could be measured to determine the inside temperature. After an exciting chase, BLT-1 was retrieved Texas-style by shooting it out of a tree northwest of Houston. Its components were carefully checked and saved for future missions.

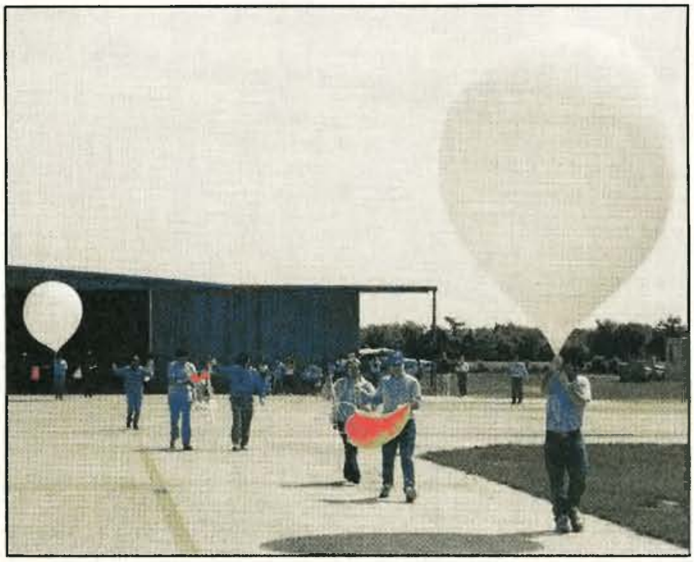


Photo A. The South Texas Balloon Launch Team (BLT) prepares to simultaneously launch two separate balloon payloads, BLT-5 and BLT-6. Photo by N5LCO.

Photo B. Mike Scarcella WA5TWT holds BLT-6 just prior to takeoff. BLT-6 contained a packet digipeater and telemetry system operating on 144.290 MHz. Also carried aloft were a series of CW beacons on 188.05 kHz, 28.437 MHz and 10.485 GHz.

```
WB5HLZ-6*>BLT-6:
Pressure= +07.211 in.Hg Inside Temp.= +070 F Outside Temp. -030 F
WB5HLZ-6*>BLT-6:
1183.2 1711.6 2572.5 6676.8
N5SHL>WB5HLZ-6*>WA5ZIB-1 [C]
WA5ZIB-1*>WB5HLZ-6>N5SHL (UA)
N5SHL>WB5HLZ-6*>CQ:
Henry at Austin, TX on 04-Apr-92 11:42 CST
WD5GAZ*>WB5HLZ-6>WALTER:
hi from waiter in houston..
WB5HLZ-6*>BLT-6:
Pressure= +06.685 in.Hg Inside Temp.= +067 F Outside Temp. -037 F
WB5HLZ-6*>BLT-6:
1165.7 1727.7 2611.1 6699.2
WB5HLZ-6*>BLT-6:
To The Edge of Space.
KG5OA>WB5HLZ-6*>N5SHL:
This is Doug From Fort Worth
N5DDN>WB5HLZ-6*>BUDDY
Tasting, Tasting, 1,2,3..."Buddy"...Shreveport, LA
```

Figure. Sample of the April 4, 1992 BLT-6 packet output as received by Tom K5SAF in West Houston.

Since that first balloon launch the group has focused on ATV from the edge of space. Telemetry became a secondary issue until April 4, 1992, when BLT-6 went up.

The group of the Houston-area balloon team grew in both size and ideas. After more launches involving video and packet digipeater efforts in 1991, it was apparent that there were more interesting experiments than room and weight constraints would allow for future endeavors. The team decided to build two separate packages for a simultaneous two-balloon launch. One payload would be focused on video efforts while the other would include beacons, telemetry and communications.

BLT-5 carried a color vidicon tube connected to a 1.5-watt PC Electronics ATV transmitter on 439.25 MHz. The antenna was a small helix aimed down. An automatic video switcher and ID screen from Elktronics were added along with a digital voice storage system and radio-controlled camera aiming system. Payload master for BLT-5 was Tony Summerville N5RPQ.

BLT-6 carried an array of beacons, a telemetry system, a 35mm camera, a

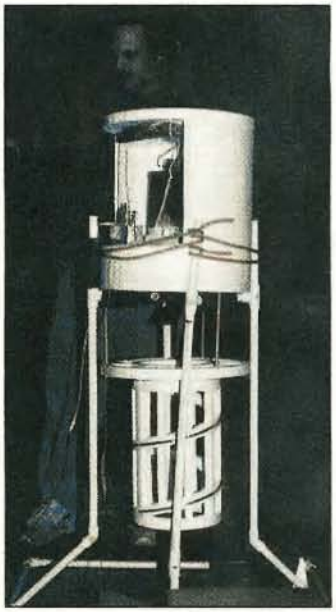


Photo C. Mike WA5TWT makes a final adjustment to the BLT-5 payload. This system carried a color vidicon TV camera, a video identifier along with a digital voice ID on the TV subcarrier and a 28.322 CW beacon. The camera view could be changed via a R/C pointing mechanism. A 2-turn helix (shown below the main package) was used for the 70cm ATV downlink.

Photo D. The view from 62,000 feet. This photo was taken from the 35mm film camera attached to BLT-6. Lake Conroe (18 miles long) is shown in the foreground and Lake Livingston can be seen in the distance.

PacComm Umpad-3 Terminal Node Controller (TNC) and a 2 meter transceiver for the packet operation. Payload master for BLT-6 was Mike Scarcella WA5TWT.

The beacons transmitted CW on 188.05 kHz, 28.437 MHz and 10.485 GHz. The VLF and HF beacons sent identifiers and atmospheric pressure readings every minute at 10 wpm. Other telemetry, including inside and outside temperature along with readings from a light-diffusion sensor experiment, were sent via unconnected packets through the Umpad-3 and transceiver on 144.29 MHz.

Most of the simple pressure and temperature measuring system incorporated In BLT-1 was used in conjunction with a small computer designed by WB5TTS to measure the frequency of the analog audio tones for the BLT-6 telemetry. Formulas for decoding the data and adding text before sending the results over the air as packets were incorporated in the software. The plain text format allowed stations involved in contacts an opportunity to monitor the on-board sensors while chatting via the digipeater. The Figure shows a small sample of the activity and data monitored during the flight.

The BLT-6 package was spotted high in a pine tree northeast of Conroe, Texas, a few hours after parachuting back after the balloon burst. A small audio beeper aided the recovery group when RF direction finding became difficult. Once again, it was necessary to shoot the payload down Texas-style with rifles. BLT-5, however, is still missing somewhere in the woods about 15 miles east-northeast of Willis, Texas. Extensive ground searches and spotting efforts by Dave K5ERP in a small plane have proved fruitless in the quest for the payload. A cash reward has been announced for the finder of that package.

The Balloon Launch Team of South Texas is currently investigating further experiments with ATV, telemetry and possibly a Mode A (2 meters up and 10 meters down) linear transponder like the RS satellites for future flights.

Why Launch Balloons?

In addition to the opportunity to experiment with telemetry, there are other reasons for launching an amateur radio package on a balloon. It is an activity that requires group participation in a fun and challenging program. It requires the participants to learn rudimentary meteorology in order to predict the balloon's path. Direction finding (DFing) is a key ingredient since the package represents the ultimate foxhunt. No one knows the location of the downed package. Designing equipment to survive the rigors of extreme temperature swings and operate in a potentially RF-rich environment can be a real challenge. Finally sending it all to the edge of space and getting it back intact is quite an experience.

In *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC, a chapter is dedicated to "So You Want to Build a Satellite." It's an incredible task. To design, build and launch an OSCAR (Orbiting Satellite Carrying Amateur Radio) requires years of work and a significant support group like AMSAT. Early satellite prototypes were tested on airplane flights over the East Coast and balloon launches in Germany. Our current hamsats have a history built on systems like those of the various organizations around the country now involved with balloon experiments. While the hamsat program provides ideas for balloon launches, the balloon flights also may provide new ideas appropriate for future orbiting payloads.

73 Review

by Bill Clarke WA4BLC

ELNEC
c/o Roy Lewallen W7EL
P.O. Box 6658
Beaverton OR 97007
Price: $49 postpaid in the U.S.A.
$3 overseas shipping
Specify coprocessor or
non-coprocessor and disk type

ELNEC Version 2.2

An updated version of the antenna modeling program.

All computer software undergoes updating from time to time, and ELNEC (first introduced in 1990) is no exception. With the updating come new features and easier operation.

What is ELNEC?

ELNEC is an easy-to-use implementation of MININEC (a comprehensive antenna modeling program developed by the Naval Oceans Systems Center). Easy implementation, in this case, means a menu-operated program with an easy-to-understand x-y-z coordinate system for telling the computer the physical design of an antenna.

The output of the program is a graphic display of an antenna's radiation pattern (ARRL-type grid style) on screen or to a printer.

Tabular formats of output are available for those who don't want visual presentations. However, a picture is worth a thousand words.

The outputs, graphic and tabular, show forward gain, beam width, front-to-back ratio, side lobe, SWR, voltage, current, and source impedance. You can indicate 3 dB bandwidth points directly on the graphic plot by selecting the "on screen analyze" feature.

The Improved ELNEC

When I first reviewed ELNEC I was disturbed by the fact that I had to recalculate each time I wished to review a previous antenna design. The new version 2.2 allows you to save files of any antenna calculated for later recall. This is really great, particularly for those complicated designs that take hours to complete on an XT.

The improved menu requires you to strike two keys before any action is taken. This allows for logical letter selections for each action, ie: FR for frequency (see Figure 1).

Radiation plots can be selected to show vertical, horizontal, and total patterns (see Figure 2). However, it is the total pattern that interests users most. ELNEC can be set to display the total pattern only

```
ELNEC ver. 2.21
(c) 1991 by Roy Lewallen, W7EL

TI TITLE:              75 dipole
FR FREQUENCY:          3.9 MHz. (wavelength = 252.1978 ft.)

WI WIRES:              1 Wire               WL WIRE LOSS: Zero
SO SOURCES:            1 Source             UN UNITS:     Feet
LO LOADS:              0 Loads
GT GROUND TYPE:        Real                    LAST FILE SVD/RCLD:
GD GND DESCRIPTION:    1 Medium, 0 Radials     ELNEC\ANTENNAS\DIP-75.EN

PT PLOT TYPE:          Azimuth              AR ANAL RES:  1 Deg.
PA ELEVATION ANGLE:    75 Deg.              RF REFERENCE: 0 dBi
PR PLOT/TABLE RANGE:   0 - 360 Deg. (full)  SZ SWR Z0:    50 ohms
SS STEP SIZE:          1 Deg.
OR OUTER RING OF PLOT: Automatic scaling
FI FIELD(S) TO PLOT:   V, H, and Total

(DE)lete, (RE)call, (SA)ve description                 <RET> = Plot
(AN)alyze   (CU)rrents   (Load D)ata   (OP)tions   (Print D)esc   (Src D)ata
(TA)ble   (View A)ntenna        (EX)it pgm without saving desc   (QU)it
```

Figure 1. New menu requiring a double keystroke before action. For example, the letters "Q" and "U" must both be pressed before the program will quit back to DOS.

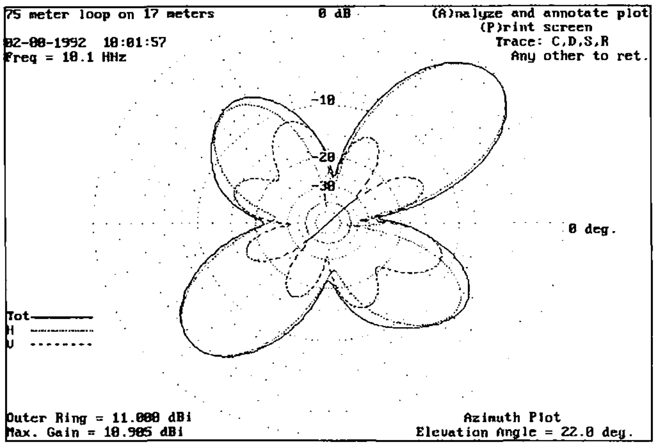


Figure 2. A complicated pattern showing both the horizontal and vertical components. The outer trace is the total (combination) field, which is often our biggest concern. It can be plotted alone (without the vertical and horizontal traces)..

```
                              WIRES
Wire Conn. --- End 1 (x,y,z : ft)   Conn. --- End 2 (x,y,z : ft)   Dia(in) Seg.

1          -100.00,  0.000, 40.000   W2E1    0.000,  0.000, 40.000   # 12    20
2    W1E2    0.000,  0.000, 40.000          85.000,  0.000, 40.000   # 12    20
3    W1E2    0.000,  0.000, 40.000           0.000,  0.000, 10.000   # 12    20
                                                                 Tot segs: 60

(number) = wire to change    A = add wires    D = delete wires
C = chg units/same nos.   G = group dia.   H = chg ant ht   R = renumber wire
T = taper segments           V = view antenna    <ESC> = return to main menu
```

Figure 3. The three wires forming a Carolina Windom: two top elements (horizontal) with a vertical element dropping from the point where the top elements join. It could be described as a top-sided letter T.

Entering the description of an antenna requires building a table of information based upon its dimensions. A simple x,y,z coordinate system is used (see Figure 3).

The source (of radio energy) is entered by telling the system its physical location. Source information is entered as a percentage of the fed element's length, requiring no pulse counting of the entire antenna.

The output of ELNEC is in text or graphical form (see Figure 4).

Source data is available for indicating various factors of the antenna including voltage, current, impedance, and power. Calculated SWR is shown as part of the source data (see Figure 5).

The new feature I feel to be the most significant is the ability to view an antenna. This provides a graphical depiction of the front, top, and right side of the antenna (see Figure 6). Sources and loads are also shown. This graphic display of an antenna you have entered in coordinate format is essential to preventing mistakes. For example, on a multi-element loop design I was working on I had erred in the wire entry section, thereby deforming the antenna. If I had not been able to view the antenna in its graphical form, the computed outputs would have been for what I had entered, not what I wanted. A visual check of antenna design work can save loads of time in correcting errors.

A Glitch of MININEC

Note that glitch applies to MININEC—therefore it includes ELNEC and any other MININEC-based system. I have found that the dB gain figures displayed in the lower left of the pattern plots can be misleading. These figures are based upon gain over the theoretical

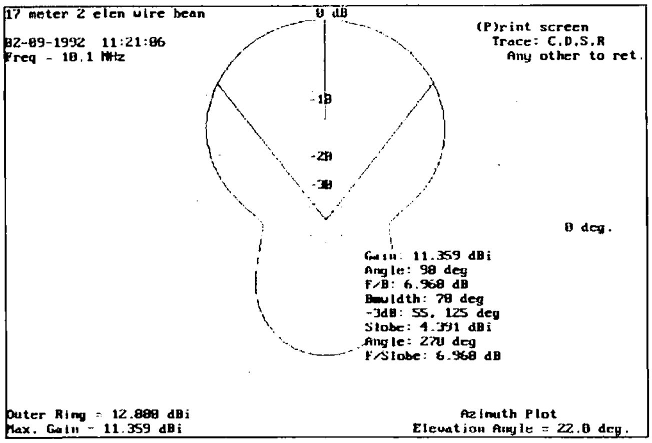


Figure 4. A 2-element wire beam for 17 meters, mounted at 40 feet. Notice the difference between the dipole's gain (in Figure 7) of 7.174 dB and this example's 11.359 dB.

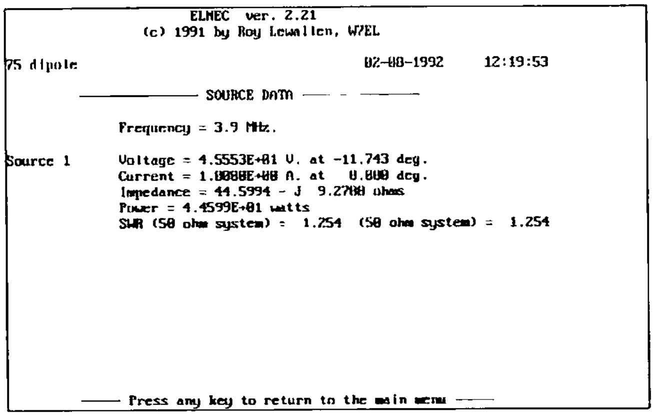


Figure 5. Source data for a 75 meter dipole includes the calculated SWR.

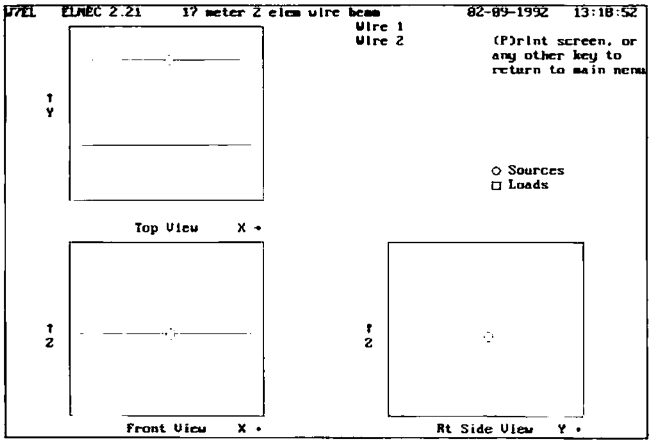


Figure 6. ELNEC provides a means of viewing your creation before calculating. This would show if any errors were made in the WIRES or SOURCE data.

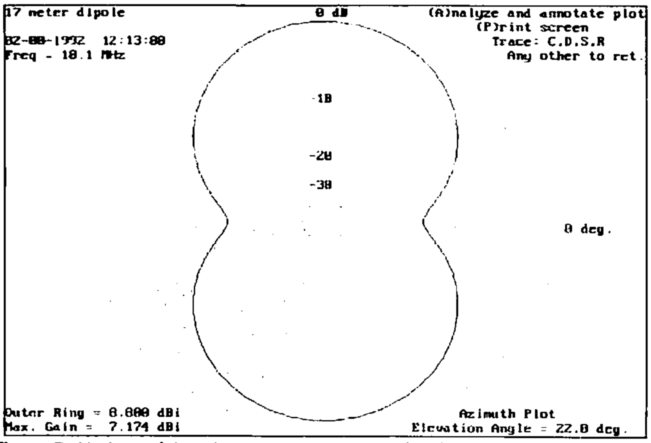


Figure 7. Horizontal (22 degrees above the horizon) pattern of a dipole for 17 meters mounted at 40 feet.

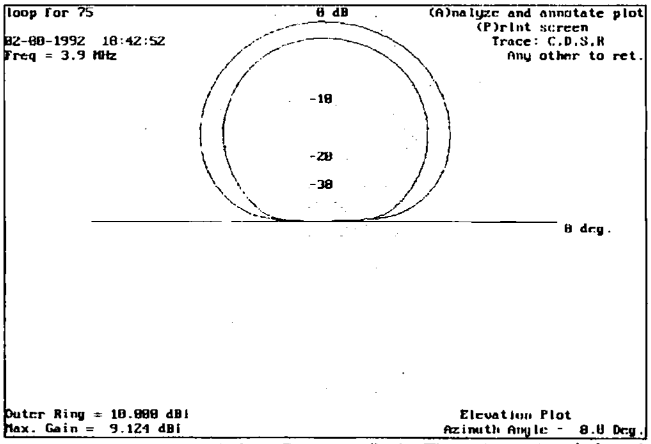


Figure 8. The inner pattern is for a 75 meter dipole. The outer pattern is for a full-sized 75 meter loop at the same height. Note the loop's gain of nearly 2 dB.

isotropic antenna and tend to be very optimistic.

For my purposes, I have always compared my designs with a standard dipole located in a similar position. The gain difference between the new antenna and the dipole indicates whether or not the design is viable (see Figures 4 and 7).

Comparing Designs

With the new ELNEC, previous calculations and plots can be saved for future use, allowing the user to super-impose the plot of other designs over a current plot. For example: In exploring the feasibility of using a full-sized 75 meter loop versus a dipole (at the same locations), I plotted the loop, then recalled the dipole pattern (see Figure 8).

Who Uses ELNEC?

Most hams are interested in antennas and how well they work. ELNEC provides a means of graphically seeing this work and allows

"With the new ELNEC, previous calculations and plots can be saved for future use, allowing the user to super-impose the plot of other designs over a current plot."

the user to make new antennas, or change old ones, to suit his needs.

An entire antenna farm can be designed with ELNEC, all during the cold winter months, then built in the spring. No "cut and try" here!

I have designed some interesting anten-nas and improved upon others by applying what ELNEC says. It is a program that most hams will enjoy and find useful. It is also sophisticated enough to provide analysis of complex designs. In other words, there is something here for everyone.

Availability

ELNEC operates in the DOS environment of "PC compatible," requiring a minimum of 360K RAM and a graphics video adapter (EGA Color is really nice). It will work with Epson or HP printers and those understanding similar commands (most do).

ELNEC comes in two specific versions: one for the computer equipped with a math co-processor and another for the plain computer. Be sure to order the correct version.

On the subject of math co-processors: If you are using an older XT or AT type machine I strongly recommend the use of a math co-processor. The increase in speed is very great and the cost should be little. In fact, the last co-processor I purchased for an XT cost me $25, a worthwhile investment.

ELNEC remains *without copy protection*, as all software should! I feel very strongly that no software should be copy protected, due to the technical problems such protection induces. 73

For additional background on ELNEC, see Bill Clarke WA4BLC's review on pages 52—54 of the January 1991 issue of 73 Amateur Radio Today.

Number 12 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

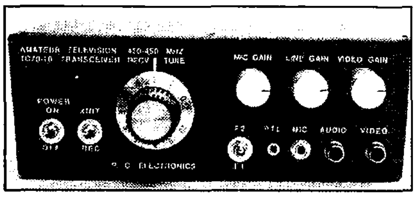
SANELLI TECHNOLOGY

Sanelli Technology has released a new code practice oscillator, the OSC-100. The OSC-100 outputs an extremely pure CW tone to an external speaker. It features separate volume and tone controls, jacks for an external 9-volt adapter, an external code key, and an external speaker. It will also operate from a 9-volt battery which is installed via the convenient battery door. It is perfect for individual or group code practice sessions.

The OSC-100 is enclosed in a durable black plastic case that fits in the palm of your hand. The faceplate resists wear and is easy to clean. The OSC-100 is priced at $39.95 plus $5 S/H (CO residents add sales tax). For more information, contact *Sanelli Technology, P.O. Box 416, Kiowa CO 80117-0416; (303) 621-2534.* Or circle Reader Service No. 201.

OVERVIEW SYSTEMS

OverView Systems has introduced AMFAX-10, an AM-to-FM converter to enhance the capabilities of the popular AEA-FAX hardware/software package for IBM compatibles. The original AEA-FAX package can only process FM FAX images transmitted on the HF band. However, all-weather FAX images transmitted directly from the satellites are AM. Inserting AMFAX-10 between the appropriate receiver and the AEA-FAX interface allows the user to receive and display VHF polar orbiting, geostationary and GOES-TAP AM weather FAX images. The AMFAX-10 converter is a quality PCB housed in a 5-5/8" (w) x 3-1/4" (d) x 2" (h) almond colored ABS plastic case. It features a front panel brightness control, LED level indicator, 12-14 VDC operation, and a built-in switch to select original FM FAX or new AM FAX modes. The AMFAX-10 appears transparent to the AEA-FAX system, providing vivid weather satellite images using existing software. It is priced at $99.95 plus $6 shipping for the complete converter and user's manual. An optional 12 VDC adapter is available for $8.95. For more information, contact *OverView Systems, P.O. Box 130014, Sunrise FL 33313; (305) 748-8315 (evenings or weekends).* Or circle Reader Service No. 204.



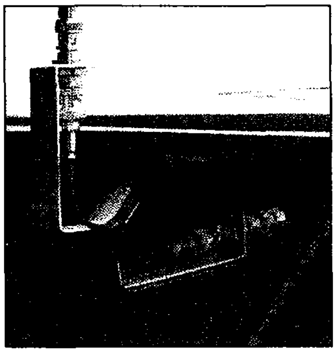
P.C. ELECTRONICS

P.C. Electronics has introduced a new 10-watt TC70-10 70cm ATV transceiver. Any code-free Tech or higher licensee can easily have his or her own ATV station with the TC70-10, camcorder, TV, 70cm antenna, coax and power supply. Aimed at those who want a rugged all-in-one-box unit for portable public service events or minimum operating table space in the shack, the rig is housed in a 7.5" x 7.5" x 2.7" black die cast aluminum box. The TC70-10 is a stand-alone 10-watt version, like the original TC-1, which was just the right power level for most users for local simplex and repeater work, providing snow-free video up to 90 miles line of sight with 14 dBd beams. New features include an internal variable sync tip power control (from to up to 15 watts PEP) and sync stretcher to allow proper driving of the Mirage D1010-ATVN or RF Concepts 4-110 to their full PEP (100 watts) output, without overdriving into sync or audio clipping, for the DXer. Separate volume controls are provided for a low impedance dynamic mike and line audio from a camcorder or VCR, which enables voice-over commenting while transmitting a home video tape. A video monitor output jack provides camera video for focus and lighting setup before transmitting, and true video RF detected at the final amp output in transmit for proper video gain adjustment. The unit comes tuned with one customer-specified transmit crystal and a socket and switch for an optional second crystal. The power supply requirement is 12 to 13 VDC at 3 amps.

The TC70-10 is priced at $499. For more information, contact *P.C. Electronics, 2522 Paxson Lane, Arcadia CA 91007; (818) 447-4565, Fax: (818) 447-0489.* Or circle Reader Service No. 205.

SIGN ON

SIGN ON produces removable callsigns designed to help protect valuable mobile radio equipment from theft in unattended vehicles. These 2-1/4" x 8" all-weather plastic magnetic or suction-cup mounted signs are designed for immediate application or removal and offer instant transfer from one vehicle to another. SIGN ON products feature the words "Amateur Radio" in addition to your callsign or favorite repeater frequency. Their easy-to-read signs may be ordered with background colors of black, blue or red; the lettering is white. When ordering, please specify magnetic (for exterior applications such as rear trunk) or suction (for interior rear window) mount. These signs are $9.95 each; two for $18. Club discounts are available. For more information, contact *SIGN ON, 1923 Edward Lane, Merrick NY 11566.* Or circle Reader Service No. 202.



TRIONICS

Trionics is now offering a power/charger (left)—a compact, versatile, rechargeable, portable power station that can supply 3, 6, 9 and 12 VDC from a 6.5 Ah safety-sealed lead acid battery. This unit is ideal for powering small amplifiers, mobile rigs, handhelds, camcorders, cellular telephones or other items in the field, and can be used as a vehicle or boat starter. This is a perfect item for emergency, Field Day, remote or portable operation needs. It can be recharged from either 115 VAC or 12 VDC power sources. The charger circuit automatically shuts off when the battery reaches a "full charge" condition. Recharge times are approximately three hours from 12 VDC or eight hours from AC. The unit features a voltage/charge meter to monitor output voltage and battery condition. The unit comes complete with a UL-listed AC charge adapter, a fused 12 VDC cigarette plug cordset and an accessory cord with multi-voltage adapters.

Trionics is also offering a new window antenna mount (right), Model BWM-1, designed to get the user's antenna out of the car and above most rooflines. This rugged metal mount fits onto the car or truck window for temporary mounting of hand-held antennas like the "rubber duck." The almost 4" height to the top of the connector is an aid in extending the range of the handheld's signal to local repeaters. The mount features a dual BNC type connector that allows the user to use his/her own coax or the optional Model BC 6-174, a 50-ohm, 6-foot, BNC-BNC, small coax cable.

The portable power station, Model CA180, is $79.95; the BWM-1 mount is $13.95; and the BC 6-174 cable is $10.95. The mount and cable are also available as a combined package for $23. CA residents add sales tax. For more information, contact *Trionics, P.O. Box 1434, Rancho Cordova CA 95741-1434; (916) 366-7408.* Or circle Reader Service No. 203.

HAMTRONICS

The Hamtronics line of VHF and UHF FM repeaters has been expanded to include some new models, including several new REP-200 Repeater options. For those who want to build their own repeater from a kit and save a little money, the full-blown REP-200 kit is now available for $1095. To make it easier, Hamtronics is supplying the control board all wired, tested and programmed. The user has to only build the RF modules and assemble the chassis. (The latter is a real treat because of the high quality aluminum chassis with RF-tight compartments welded in place and covers held on with captive nuts.) For hams who don't want autopatch, Hamtronics is offering the REP-200V Repeater in kit form with the COR-4 Controller instead of the microprocessor-based controller, for $795. The COR-4 has COR and CW ID features, but no DTMF or autopatch features. Another variation is the REP-200N ($695 kit, $995 wired and tested), with no controller, for hams who want to use voice ID and the other advanced features of an ACC-type controller. On this model, the connections from the RF modules terminate at feedthrough capacitors in the shielded compartments, allowing external controller connections to be made directly without having to buy or modify any existing controller board.

All of the above repeaters are available for 6 meter, 2 meter, 222 MHz, and 440 MHz ham bands, and they are FCC-type accepted for operation in the commercial hi-band and UHF band. Basic output power levels are offered from 10W to 25W, depending on frequency. Add-on PAs are also available.

For operation in the 902-928 MHz band, Hamtronics has a 10W model of the full-blown, wired/tested REP-200 Repeater for $1455. Add-on PAs are also available.

For more information or a full catalog, contact *Hamtronics, Inc., 65 Moul Road, Hilton NY 14468-9535; (716) 392-9430, Fax: (716) 392-9420.* Or circle Reader Service No. 206.

Number 13 on your Feedback card

ATV

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03449

The NTSC ATV Repeater

Members of NTSC (the North Texas Synchronization Society) in the Dallas-Ft. Worth area have built a rather unique ATV repeater system. Located on a commercial TV tower (KTVT channel 11) at the 1270-foot level (AGL), the coverage around the area is tremendous. The NTSC group chose an output on 421.25 MHz (horizontally polarized) to make it easy for those who had cable-ready TVs or VCRs to tune in via cable channel 57. Since most of the commercial TV stations are located near the NTSC site, area residents with outside TV antennas already have their antennas pointed in that direction. As a result, its very easy for ATV newcomers, or those curious about the mode, to tune in to the action without having to buy specialized downconverters or antennas. A large viewing audience is possible since there are several hundred thousand people with horizontal TV antennas and cable-ready TVs in the region.

Doppler Radar

The NTSC system has access to a very fine Doppler radar system located in Corsicana. This radar is owned and operated by Weather Radar Warning System, Inc. The Doppler radar system is brought up during severe weather and is used to look for storms with tornado potential. Thanks to a grant from the Tarrant County Firefighters Association, NTSC was able to purchase the equipment necessary to bring the Corsicana radar output up into the Dallas-Ft. Worth region. This link consists of a TD systems CU-125 and a 10-watt 915 MHz FM-TV transmitter mounted in front of a Decibel Products DB-495 corner reflector antenna at 60 feet. The link covers a 45-nautical-mile path and is solid even when the heaviest of storms pass through the area. When not used for weather radar, the 915 MHz FM-TV frequency is used as the general user input to the ATV repeater.

FM-TV Input

Since the input uses FM-TV, the method of switching between the weather radar and general purpose users is rather unique. The repeater receive antenna for the weather radar is a *vertically* polarized corner reflector. The general user input antenna is an 8-bay zig-zag omni-directional *horizontal* antenna built by Steve Franklin WB5KGL. To change the feed between general purpose users and the weather radar, a touch-tone command causes a relay to switch in one of the antennas. The capture effect of FM-TV allows the weather radar to run continuously without interfering with local users.

The Transmit Chain

The 421.25 MHz ATV transmitter system consists of a 2-watt exciter built by Steve Franklin WB5KGL. A Mirage D-100ATV, a 7-pole indigital filter built by Arlyn Stewart AA5BY, a pair of cavities donated by Andy Carstarphen WY5V and 45 feet of 1/2" Heliax and connectors donated by Merle Taylor WB5EPI.

The antenna array (constructed by Harold Reasnor K5SXK) consists of four horizontally polarized dipoles placed in a staggered arrangement down the face of a 6-foot-long, 6" diameter section of coaxial transmission line donated by Sandy Sandberg N5NBW. The staggered arrangement of the dipoles achieves a cardioid type pattern that favors the west, north and south. This pattern was chosen to avoid the possible multipath effects of the side-mounted antenna and to con-

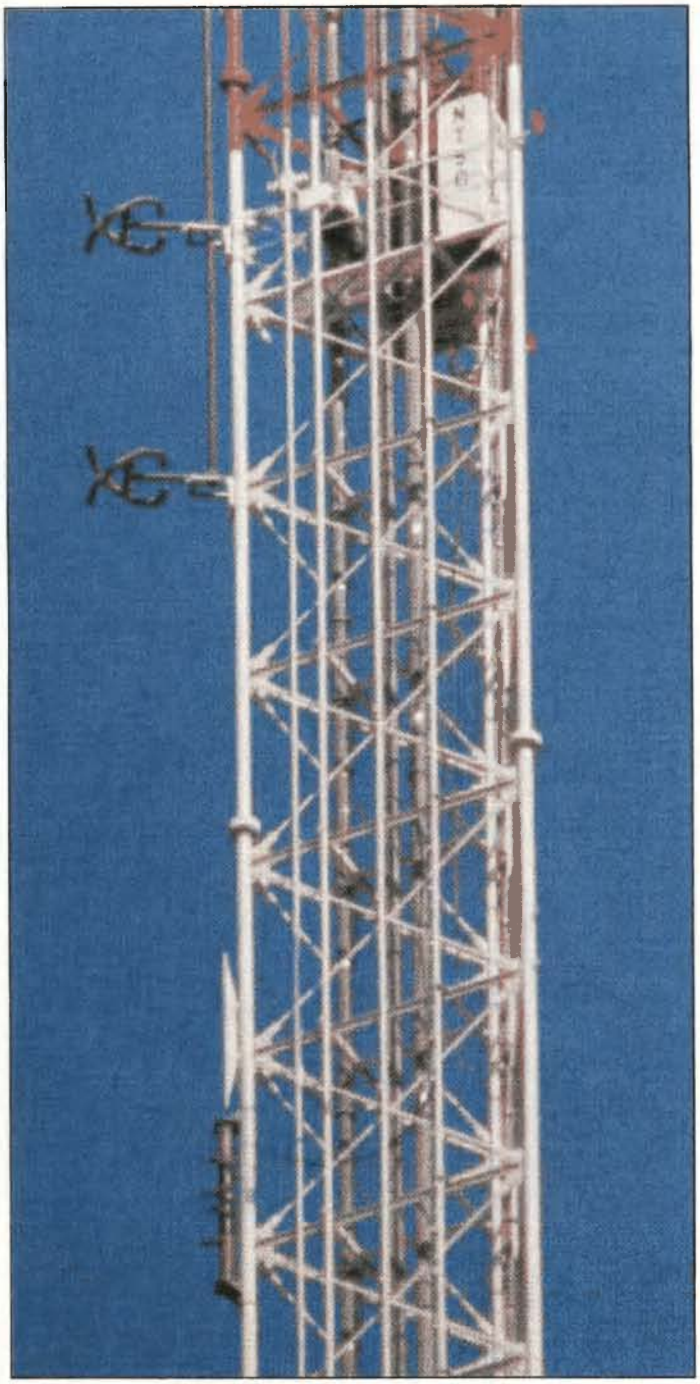


Photo A. The NTSC ATV repeater is situated at the 1270-foot level of a commercial TV tower near the Dallas-Ft. Worth area. Photo taken by Robert Skegg VE7AII/W5 through a high-power lens.

centrate the most signal towards the largest viewing area. Even with a null almost straight south, the repeater has been seen as far south as Waco (70 miles away).

The 915 MHz FM-TV Receive System

The 33cm receive system consists of a high-level downconverter, a SAW type IF filter and a 70 MHz FM demodulator. The downconverter was specially built to withstand the high RF environment at the repeater site. The repeater is co-located with two commercial TV transmitters (KTVT channel 11 and KERA channel 13, as well as KERA-FM and KEGL-FM). With this concentration of RF energy, camcorders and most film cameras don't function and attempts to photograph the equipment rack sometimes results in a camera with fried electronics. Photo A, showing the ATV repeater in place at the 1270-foot level of the tower, was taken from a half mile away through a high power lens.

The 1277.25 MHz Input

The 23cm input accepts regular AM-TV signals. The receive antenna is an omni-directional, horizontally-polarized, Alford slot built by K5SXK and K5BYS. Forty-five feet of Heliax (donated by Merle Taylor WB5EPI) feeds into the repeater cabinet. The downconverter/demodulator was built by Steve WB5KGL.

Control

The video inputs are selected by touch-tone commands through use of a controller built by John Holmes WA5WXA. The unit has four video and audio inputs and two video and audio outputs. Output relays are provided for keying transmitters, switching antennas and other control functions.

Activity

There are always a number of active users in the region. During space shuttle missions, the system also transmits the NASA Select video. During severe weather, the Corsicana Doppler radar has been an invaluable aid to storm spotters and the the National Weather Service office in Ft. Worth. It seems that the NWS was not able to see the Corsicana radar feed in the past and had to actually use an FM voice link to have the radar operator describe what he was seeing on the display. The NWS now has an ATV downconverter and, for the first time, can actually SEE the display via the NTSC repeater!

Several storm spotters are gearing up to go ATV mobile so they can relay

Photo B. The NTSC logo and repeater test pattern.

Photo C. In the WY5V/N5LLF hamshack. (l to r): NTSC president Andy Carstarphen WY5V, Thurman "Camcorder Curly" Ganey N5SFQ and vice-president and program director David McNeil KI5VM.

live storm spotting and on-site damage assessment via the NTSC repeater.

There has also been some successful experimentation with airborne ATV. A recent helicopter flight yielded P5 pictures from 35 miles out from a 10W transmitter and a pair of stacked nanowheel antennas built by Dave Clingerman W6OAL of Olde Antenna Labs in Denver, Colorado. This antenna array was specially designed for NTSC for aircraft use and was wind tunnel tested to 200 knots.

Most users can access the ATV repeater using 1-watt transmitters (antenna-mounted) if they live within 30 miles. Beyond that point 10- or 20-watt stations are needed. There is also a 2 meter FM receiver located at the repeater on 144.340 MHz. This frequency is used for coordination of ATV activity in the Dallas-Ft. Worth area. The audio received by the repeater on 144.34 can be mixed in with the ATV subcarrier (or even on-carrier for special occasions) so anyone watching the repeater can hear the activity. This makes round-table conversations very easy and encourages receive-only stations to participate.

Co-Existing on the 900 MHz Band

Some final notes for those interested in using FM-TV. The NTSC group highly recommends the use of FM-TV and the use of the 900 MHz band in a repeater installation or link. Their "narrow-band" (as compared to wide-band satellite TV transmissions) FM-TV signal occupies just a little more bandwidth than a double-sideband AM transmission.

Also, there is a Teletrac vehicle locating system on the air on the 900 MHz band in the area. By careful choice of frequencies, mode of emission, polarization and power, the NTSC group was able to successfully live with their spectral neighbors. In fact, when they approached the Teletrac people recently to introduce them to the NTSC system, they weren't even aware of the NTSC presence on the band. It appeared that the vehicle location systems have more problems with interference from part 15 devices than with the much higher power amateur transmissions.

Future additions to the NTSC repeater may bring a selectable FM-TV input/output on 1248 MHz and an FM-TV output on 2434 MHz.

Photo E. Using just 10 watts, Charlie Kilgore N5MYG puts in a P5 signal from a distance of 72 miles.

Photo F. Weather satellite enthusiast Jeff Wallach N5ITU works the repeater from a distance of 28 miles on 915 MHz FM.

Photo D. Ron Jackson N5OJT works through the repeater via the 915 MHz FM input.

Join in the Fun

If you live in the Dallas-Ft. Worth area or are just passing through, you're welcome to tune in to the system. The repeater output is up and running most of the time. Just give a call on 144.34 and one of the members should hear you. There is an ATV net every Wednesday evening at 8:30 p.m. on the 147.14 (+600) Arlington repeater as well as the NTSC ATV repeater.

Andy WY5V maintains a telephone number for NTSC for those wishing more information. The NTSC hotline is (214) 289-WY5V. You can also write to Andy Carstarphen WY5V, c/o NTSC, Inc., 1409 Wesley Dr., Mesquite TX 75149-5667.

Number 14 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-924-9343) for listings that were too late to get into publication.

JUN 1992

NEWMARKET, ONT., CANADA The York Region ARC is sponsoring the YRARC National "Young Amateur of the Year"Award to help promote the hobby of amateur radio among the youth of Canada. The prize offered to the winner of this award is $500. First and second runners-up will receive $200 and $100 respectively. Submissions for the award will be welcomed from any official of an affiliated CARF or CRRL Club throughout Canada. Details of the candidate, his or her age and accomplishments in the field of ham radio, are the basis for the judging. Candidates must hold a Canadian amateur radio license and be a Canadian resident. Good quality photographs of the candidate will be a definite advantage. Submissions, including details of the sponsor and sponsoring club, should be forwarded before Aug. 31, 1992 to ***Attn: Awards Committee, The York Region Amateur Radio Club, PO Box 352, Newmarket, Ont., L3Y 4X7, Canada.*** The awards will be presented in November at the York Region ARC Hamfest. For more info, call ***Mr. Andrew Betterton VE3ORE, (416) 895-8710.*** All awards are made at the discretion of the YRARC.

DICKINSON, ND The Theodore Roosevelt ARC will sponsor a "North Dakota Worked All Counties" certificate, beginning immediately. The certificate is available to Ham and SWL enthusiasts. At this time there is no date set for discontinuation. For an application form, send a #10 SASE to ***Steve Allar N0ELA, 1701 6th Ave. NE, Beulah ND 58523.***

JUN 6

ALAMOGORDO, NM The Alamogordo ARC will sponsor VE test sessions at 12 noon. Persons already holding an amateur license and wishing to upgrade must bring their original license and CSCE (if any), and a copy of both. Talk-in on 146.80, down 600. For info, contact ***Ole WA5IPS, (505) 437-5896; or Larry WA5UNO, (505) 437-0145.***

SOUTH BURLINGTON, VT The Radio Amateurs of Northern VT will sponsor the Northern Vermont Summer Hamfest and Computer Technology Fair from 8 AM-3 PM at the South Burlington Middle School Complex, Dorset St., off of I-89 exit 14-E. Indoor/outdoor Flea Markets. Close proximity to shopping malls. VE Exams will be given at 2 PM. Admission $3, free for under 18 years. No charge for flea market spaces. Tables available. Talk-in on 146.25/.85. Hamfest contact: ***N1DMP, (802) 893-6458.*** Exams contact: ***WB2JSJ, (802) 879-6589.***

JUN 7

PRINCETON, IL The Starved Rock RC Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Advance tickets $4 (before May 20th) and $5 at the gate. Free camping and outdoor Flea Market area. 8' tables indoors are $10 ea. Talk-in on 146.355/.955. Contact ***Bruce Burton KU9A or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.***

JUN 8

BOULDER, CO The Boulder VE Team will conduct VE Exams at St. Mary Magdalene Episcopal Church, Heatherwood Dr. and Cambridge St., starting at 7 PM. Contact ***Barbara McClune NØBWS, (303) 530-2903.*** Pre-registration preferred; walk-ins welcome. Please bring a picture ID and one other ID; check or money order for $5.40, payable to ***ARRL-VEC***, the original and one copy of your current license (if any); the originals of applicable Certificates of Successful Completion of an examination, if you claim credit for any test elements; a copy of the FCC 610 you submitted, if you claim credit for a Novice license not yet received; soft pencils and a calculator.

JUN 12

ELLENVILLE, NY The Chaverim 6th Int'l Convention, sponsored by an assn. of Jewish amateurs and their friends, will be held at the Fallsview Hotel. For details, contact ***Arnold L. Halpern W2GDS, 450 Brighton Ave., Long Branch NJ 07740. Tel. (908) 222-3009.***

JUN 13

WINSTON-SALEM, NC The Forsyth ARC will sponsor the Winston-Salem Hamfest/Computer Fair from 9 AM-5 PM at the Benton Convention Center, downtown. Flea Market. VE Exams (pre-register). Admission $5 in advance, $6 at the door. SASE to ***Henry Heidtmann, Winston-Salem Hamfest, PO Box 11361, Winston-Salem, NC 27116. Tel. (919) 785-3900 (9 AM-10PM).***

MARMORA, ONT., CANADA The Eastern Ontario Hamfest, sponsored by the Marmora ARC, will be held at Marmora Area Curling Club starting at 9 AM. Admission $3. Tables $5. Tailgate $2. Talk-in on VE3TZW 146.655/.055 rptr. Contact ***George Foster VE3NKJ, (613) 472-5948.***

LOVELAND, CO The Northern Colorado ARC will present Superfest IX at the Larimer County Fairgrounds, 700 S. Railroad, beginning at 8 AM. Set-up Fri. eve. Jun. 12, or at 6 AM Sat. Free parking. ARRL VEC Exams. Camper hookups. Admission $3. Tables $7 ea. (for reservations contact ***Bill Morrison NØKMA, 1743 Eastwood Ct., Ft. Collins CO 80525. Tel. (303) 224-5305).*** For info, contact ***John Schmidt NKØR, 1001 King Dr., Loveland CO 80537. Tel. (303) 663-7581.***

BANGOR, ME The Pine State ARC will sponsor the Bangor Hamfest/Computerfest at the Hermon Elementary School. Take US #2 to Hermon Corner (at the monument) take the Billings Rd. for 2 miles to the school. Follow the signs. Free parking. Flea Market. VE Exams, all classes. CW contest. There are 3 campgrounds and many motels within 5 miles of the Hamfest. Contact ***Roger W. Dole KA1TKS, RR #2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.***

HUNTINGTON, WV The Tri-State ARA, Inc., will offer VE Exams at Our Lady of Fatima church school classrooms, located at 545 Norway Ave., Huntington WV, at 10 AM. No pre-registration necessary. Arrange to arrive by 9:15 AM to register. Have ID and Form 610 checked prior to the exam. For more info, call ***Jim Baker K8KVX, (304) 736-6542.***

JUN 14

HUMBOLDT, TN The Humbolt ARC Hamfest will be held at the Humboldt High School Cafeteria, 2600 Viking Dr., from 8 AM-4 PM. Admission $5. Tables $5. Contact ***Ed Holmes W4IGW, 501 N. 18th Ave., Humboldt TN 38343. Tel. (901) 784-3490.***

STEVENS POINT, WI The Central Wisconsin Radio Amateurs, Ltd. (CWRA), will hold its 15th annual SWAPFEST at the University Center on the U. of Wisconsin-Stevens Point campus. Free parking. Wheelchair accessible. ARRL VE Exams. Tables and electrical power will be available for commercial vendors. For info and registration, contact ***Art Wysocki N9BCA, CWRA Swapfest Chairman, 3356 April Lane, Stevens Point WI 54481. Tel. (715) 344-2984.***

WINFIELD/CENTRAL, PA The SVARC and Milton ARC will co-sponsor a Hamfest at the Winfield Fireman's Grounds (60 miles North of Harrisburg, on US Route 15). VE Exams by pre-registration. Admission $4. Outside table/tail-gate space at $1/6'. Contact ***SVARC, Inc., Box 73, Hummels Wharf PA 17831. Tel. (717) 473-7050. Packet KD3KR @ NR3U.PA.***

LANCASTER, NY The Lancaster ARC will hold their Hamfest at the Elks Club Hall, Rt. 20-Broadway in downtown Lancaster, across from the post office. Large parking lot for outdoor Flea Market and general Hamfest parking. Admission $4 in advance till May 1, or $5 at the door (includes 8' outdoor flea market space). Vendors, contact ***Nick WA2CJJ, 5645 Genesse St., Lancaster NY 14086. Tel. (716) 681-6410; or George Ebert N2NOB, 1330 Bailey, Buffalo NY 14206. Tel. (716) 894-0343.*** Talk-in on 146.550 simplex or 224.640 rptr.

WILLOW SPRINGS, IL The 35th annual Hamfest, sponsored by the Six Meter Club of Chicago, Inc., will be held at Santa Fe Park, 91st St. & Wolf Rd., Willow Springs IL. Advance tickets $4, $5 at the gate. Large swapper's row. Free parking. Get advance tickets from ***Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441,*** or any club member. No overnight camping. Gates open at 6 AM. Talk-in on 146.52 K9ONA/R 37-97.

COVINGTON, KY The Northern Kentucky ARC announces "HAM-O-RAMA 92"to be held at the Erlanger Kentucky Lions Park beginning at 8 AM. Set-up at 6 AM. Indoor exhibit area for major vendors. Outside Flea Market. Admission is $5 ($4 in advance) with children under age 13 free. Flea market spaces are $2. Bring your own tables. Indoor vendor space $15 per table (provided). For info and registration, contact ***KC4FET c/o NKARC, PO Box 1062, Covington KY 41012. Tel. (606) 341-1213.*** Talk-in on 147.855+ or 147.375+ rptrs.

GRANITE CITY, IL The Egyptian RC will conduct its annual EGYPTIANFEST at the club grounds on Chouteau Place Rd., Granite City IL., from 6 AM-2 PM. Overnight camping Sat. VE Exams will be conducted at the Sanford Brown Business College, 3237 W. Chain of Rocks Rd. Pre-registration is requested, but not required. The class is limited to 60. Contact ***Eric Koch NFØQ, (314) 946-0948*** to pre-register. Advance tickets $1 or 6/$5; $2 or 3/$5 at the fest. Contact ***Jim Cleland K9RKU, PO Box 562, Granite City IL 62040,*** or call ***(618) 344-2401*** for info or tickets.

AKRON, OH The Goodyear ARC's 25th annual Hamfest/Family Picnic will be held at Wingfoot Lake Park near Akron OH, from 8 AM-4 PM. Family admission is $4 in advance, $5 at the gate. The outside Flea Market will be $3 per space. Inside dealer area $6 per table (advance reservations suggested). No overnight parking. No pets, no swimming please. For advance tickets and info, contact ***William F. Dunn W8IFM, 4730 Nottingham Lane, Stow OH 44224, Tel. (216) 673-8502.***

JUN 19-21

BURBANK, ALBERTA, CANADA The Central Alberta Radio League will sponsor their 21st annual Picnic at the Burbank Campground, located at the confluence of the Blindman and Red Deer River valleys. Registration starts Fri. afternoon. $15 per family unit camping fee. $10 single unit camping fee. $10 weekend private stall. $5 Sat. evening barbecue and dance (at 1800 h). Children under 12, $3. $6 per weekend pass (no camping). Event Station call VE6UK, 147.150+ 0.600 MHz; simplex 146.520. For further info and Golf registration, telephone ***Pat Wight VE6ALD, 346-3013.***

JUN 20

CYPRESS, CA The Catalina Amateur Repeater Assn. will hold its annual HAMFEST indoors at Cypress College, 9200 Valley View St., Cypress CA (just west of Knott's Berry Farm), from 9 AM-4 PM, in the Math/Science Bldg., near the lake. Admission $10, includes hamburger/chili luncheon. VE

VE Exams. Vendors need to reserve space. Contact ***Jo Ann Taylor KC6NJG, (714) 777-1260, or FAX (714) 779-7761.***

MIDLAND, MI The 18th annual Hamfest, sponsored by the Central Michigan Amateur Rptr. Assn. (CMARA), will be held at the Community Center in Midland MI from 8 AM-1 PM. Admission $3. Tables $9 each. Talk-in on the Midland 147.60/.00 rptr. VE Exams, walk-ins welcome. Contact ***CMARA Hamfest, PO Box 67, Midland MI 48640.*** Please SASE. Or call ***Joe WD9GUF at (517) 631-8818,*** eves. and weekends.

JUN 20-21

WOLF POINT, MT Prairie Radio Club will host the annual Northeast Montana Hamfest Picnic at Wolf Point MT. Contact ***Jack Greenwood WB7QDN*** for info.

JUN 21

CROWN POINT, IN The Lake County ARC will host their 20th annual Dads' Day Hamfest at the Lake County Fairgrounds, beginning at 8 AM. Indoor spaces. Set-up at 6 AM. Admission $4. Tables $6. VE exams. Talk-in on 146.52 simplex and 147.00/.60 rptr. Contact ***Mike Warot KA9DGX, 7751 Chestnut Ave., Hammond IN 46324. Tel. (219) 845-7970.***

MONROE, MI The Monroe County Radio Communications Assn. will sponsor a Hamfest at Monroe County Fairgrounds, M-50 at Raisinville Rd., Monroe MI. Handicap parking. VE Exams. Advance tickets $3, $4 at the gate. Indoor tables $10 per 8' table. Trunk sales $3 per 8' space. Contact ***Fred Lux WD8ITZ, PO Box 982, Monroe MI 48161. Tel. (313) 243-1053 eves.***

CAMBRIDGE, MA The MIT Radio Society and the Harvard Wireless Club will co-host a TAILGATE electronics, computer and amateur radio FLEA MARKET, rain or shine, at Albany & Main St., Cambridge MA from 9 AM-2 PM. Free off-street parking. Admission $2. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. For info or reservations, call ***(617) 253-3776.*** Mail reservations before June 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in 146.52 and 449.725/444.725 pi 2A W1XM rptr.

FREDERICK, MD The Frederick ARC will hold its annual Hamfest on Father's Day at the Frederick County Fairgrounds from 8 AM-4 PM. Admission $4. Tailgaters $5 for each 10' space. Wives and children free with one paid admission. Indoor tables $10. For info, write to ***Frederick Hamfest, PO Box 1260, Frederick MD 21701.***

JUN 28

SOUTH BEND, IN A Hamfest Swap & Shop will be held in PARKING GARAGE Downtown on U.S. 33 ONEWAY North by the Society Bank Bldg. and Century Center, across the street from Winter Hamfest. Free parking nearby. Admission $3. Drive-in selling spaces $5 ea. Talk-in on 52-52, 99-39, 69-09, 34-94, 145.29. Contact ***Wayne Werts K9IXU, 1889 Riverside Dr., South Bend IN 46616,*** or phone ***(219) 233-5307.***

MILFORD, CT At 12 noon, the Coastline ARA will hold VE Exams for all classes at the Fowler Bldg., 145 Bridgeport Ave., Milford CT. Walk-ins welcome. Contact ***Gary NB1M, (203) 933-5125, or Dick WA1YQE, (203) 874-1014.***

JUL 4

HARRISBURG, PA The Harrisburg RAC will hold a Hamfest at the Bressler Picnic Grounds from 8 AM-2 PM. Set-up at 6 AM. Take Exit #1 if I-283, PA #441 North. Follow signs. Admission $4. Tailgating $6 per space. Tables $10 in advance, $15 at the Hamfest. Call ***Steve Gobat KA3PDQ, (717) 938-6943*** for table reservations.

JUL 11

SUMMERVILLE, SC The Trident ARC will sponsor CHARLESTON II Summer HAMFEST/COMPUTER Expo at the Charleston Southern U. Fieldhouse, I-26 (Exit 205) and US-78 East, from 0800Z-1500Z. Set-up at 0600Z. Wheelchair accessible. Free parking. There will be a True-Auction at 1400 hrs. Advance tickets $6 per family; $5 each at the gate. Tailgate $3. Pre-registered tables $10. Talk-in on 147.27+, 224.64- or 443.80+ Contact ***Chairman, Bubba Johnson N4CII, 5 Shoo Fly Cir., Givhans SC 29472; (803) 821-8100*** recorder, or ***(803) 871-7741.***

SPECIAL EVENT STATIONS

JUN 6-7

KEENE, NH Station KD1GJ will operate at the Monadnock Region Hot Air Balloon Festival, from 1400Z-2300Z each day. Frequencies: Lower portion of General phone bands on 80, 40 and 20 meters; Novice subband on 10 meters. For QSL, send QSL with SASE to ***KD1GJ, 52 Manchester St., Keene NH 03431.***

PHILADELPHIA, PA The USS Olympia RAC will sponsor Station WA3BAT aboard the USS Olympia, in conjunction with the US Naval Academy (W3ADO, USS Yorktown (W4USN), USS Little Rock (W2PE), USS Pompanito (WA6BXV), and the USS Drum/Alabama (K4RQQ), from 1400-2300 UTC, to commemorate the birthday of John Paul Jones, father of the American Navy. Frequencies: Phone-3.895, 7.245, 14.245, 21.365, 28.365 (all +/- 5 kHz). For a certificate, send QSL and a 9 x 12 SASE to ***Olympia RAC, PO Box 928, Philadelphia PA 19105.***

JUN 13-14

WARRENTON, VA The Fauquier ARA will operate Station K4LLQ at the US Army Communications-Electronics Command, Vint Hill Farms Station, Warrenton VA, during the Golden Anniversary celebration of this historic citadel of electronic warfare. "The Farm" was originally created as "Monitoring Station No. 1" during WWII to intercept radio transmissions. K4LLQ will operate 1300Z-2200Z. Frequencies: SSB-7232, 14232, 21322, 28432 kHz. CW contacts on request. Frequencies may move, depending on band conditions. QSL, SASE, or multi-color certificate (9 x 12 SASE and $3) to ***Fauquier ARA, 500 Hunton St., Warrenton VA 22186.***

CLINTON, IA The Clinton ARC will operate WØCS to commemorate the 1st anniversary of Riverboat gambling out of the port of Clinton IA. The station will be aboard the Mississippi Belle II floating casino. Operation will be from 0900-2100 CDT both days, in the lower 50 kHz of the General phone sub bands; on 40, 20, and 15 in the Novice segment on 10 meters. Also, 144.210+/- phone for EN41/EN42. QSL with #10 SASE to ***Darryl Petersen KD0PY, 1344 400th Ave., Bryant IA 52727.***

JUN 14

FT HAMILTON-BROOKLYN, NY The Kings County Rptr. Assn. will operate Station WA2ZWP from 1200Z-2400Z, at the base of the Varrazano Bridge, to celebrate the 167th anniversary of Fort Hamilton Army Post. Operations will be in the General and Novice phone bands around 28.343, 21.343, 14.343, 7.243. For certificate, send QSL and SASE to ***Charles Quartana N2JZA, 2175 East 8th St., Brooklyn NY 11223.***

JUN 20-21

JUNCTION, TX Pat Rose W5OZI will sponsor 1992 SMIRK Party Contest #17, from 0000 UTC June 20-2400 UTC June 21. To obtain a copy of the official log sheet, send SASE to ***Pat Rose W5OZI, PO Box 393, Junction TX 76849 USA.*** Contest entries must be postmarked no later than 6 July 1992 and sent to the W5OZI address.

ALTOONA, PA The Horseshoe ARC will operate Station W3QZF from 1300Z June 20-2100Z June 21, to celebrate the 1992 US Cycling Federation Olympic Road Trials and Nat'l Championships that will be held in Altoona. Frequencies: Lower portion of the General phone privileges on the 40-15 meter bands; and the lower portion of the 10m Novice phone sub band. QSL with SASE to ***HARC, PO Box 225, Hollidaysburg PA 16648.***

JUN 27-28

NORFOLK, VA The Tidewater ARC will operate Station W4NV 1600Z June 27-1800Z June 28, to commemorate the establishment of the US Army's Fort Norfolk as an historic landmark. Operation will coincide with Field Day and will be in all bands 80-10 meters, CW and phone, plus AO-13. For QSL, send QSL and SASE to ***Tidewater ARC W4NV, 1234 Little Bay Ave., Norfolk VA 23503.***

JUN 29-JUL 12

NIAGARA-ON-THE-LAKE, ONT., CANADA The Niagara Peninsula ARC, Inc., will commemorate the Bicentennial of John Graves Simcoe, First Lieutenant Governor of Upper Canada, Niagara-on-the-Lake, by operating Station XJ3S on 80 thru 10 meters SSB, CW, and RTTY. For a special QSL card, send a QSL, SASE (USA funds and postage OK) to ***VE3VM, Niagara Peninsula ARC, PO Box 692, St. Catharines, Ont., L2R 6Y3, Canada.***

Number 15 on your Feedback card

UPDATES

Crystal Matching and Activity Tester

The May 1992 "Circuits" column (page 64) has an error in the schematic. The 560 ohm resistor connected at one end to pin 3 of the 7400 is shown connected to pin 1. This won't work! This register must be connected between pin 3 and pin 2 of the 7400.

Also, although not noted in this piece, both inputs of the two remaining gates should be connected to ground—the gates not used, in the remaining sections of the 7400. I should have mentioned this but I guess I sort of assumed everyone would know one can't leave the gate inputs on unused gates hanging.

J. Frank Brumbaugh KB4ZGC
Bradenton FL

The SAM1 Transverter

There are changes to the information in the "VLF Information Sources" section of the article "SAM 1 Transverter" in the April 1992 issue (page 36). Since the first of the year (1992), both the *Northern Observer* and the *Western Update* have ceased publication. The information that would normally be included in these publications will now be included in the Longwave Club of America's monthly publication, the *LOWDOWN*. Their address is: The Longwave Club of America, 45 Wildflower Rd., Levittown PA 19057.

Due to the enlarged issues of the *LOWDOWN*, dues for the LWCA have increased to $18/year USA, $19 Canada (1st class), and $26 US funds airmail for overseas.

I hope the above information will be of interest to your readers.

Ken Cornell (ARS W2IMB)
Point Pleasant Beach NJ

The Rock Bender QRP Transmitter

The caption for Figure 5 in the above article in the April 1992 issue (page 22) contained an incorrect equation. If R is the local resistance and E is the voltage indicated by the DC voltmeter, then power = $(0.707E)^2/R$, **NOT** $(0.707E^2)/R$.

DXpedition Lessons from Peter I and Bouvet Islands

The callsign of Roald Steen, the author of the above article in the May 1992 issue (page 46), is AJØN/LA8US, **NOT** AJØN/LA6US.

HEIGHTS TOWER SYSTEMS

Continued from page 44

entertainment value the project will provide for your neighbors as they watch your antics on the tower.

I found that the sections would go together easier if I used a tapered line-up pin, available from Rohn at big bucks or local hardware stores for much less. Oddly enough, I was told by ham tower dealers that they either did not know what this tapered pin was, or if they did know what it was they did not sell it and instead suggested the local hardware store. Why the big deal about this tool? It is one of Mr. Murphy's Laws that all six holes on a tubular tower's legs will never line up without divine intervention. No reflection on Heights here; this happens with them all.

There are too many things that have to line up perfectly on top of a tower for it to work easily with a slightly canted tower under assembly. We really appreciated Heights' use of captive nuts instead of nuts with separate lock washers. One less piece of hardware to drop, right? I did quickly learn that before putting a captive nut on a bolt, the bolt must be clean. Any dirt on the bolt threads tends to seize the nut so it cannot be further tightened or removed. Now would be a good time to advise that you pre-acquire several spare bolts and nuts when starting the construction. Actually, I caused part of my own problem at first, since the first dirty bolt I encountered was fouled with the joint compound I was using. I used an aluminum-to-aluminum joint "grease" between section legs to prevent corrosion, improve conductivity, and facilitate future disassembly. These compounds contain finely ground aluminum powder in a lubricating base, and work fine until you get the compound between a bolt threads and a captive nut.

By now your new gleaming tower is up and ready for antennas. I'll leave that to other articles. Just one last piece of information you now need to stay sane: All self-supporting towers, and especially long tall ones, will "wiggle." If you get bothered by waves when on a boat, you may notice this effect more than others. The motion of the tower at the top is actually very slight, but will be definitely noticeable when you are up there. The tower is much stronger when it can wiggle with the wind a little instead of trying to stay rigid. It's funny; the tower looks shorter from the ground up than when you are on top looking down. Maybe this is a result of the tapered design?

If you've done it right so far, you now have a marvelous tower to support your DX dreams, and which will make a great, neighbor-pleasing Christmas light display support. I've put up a lot of different towers over the years, and I am quite favorably impressed with the Heights product. Youcan't go wrong with this company's customer relations—I've never seen anyone friendlier or more cooperative than Drake Dimitry at Heights. 73

Contact Mike Baker W8CM at 306 Woodberry Lane, Lynchburg VA 24502.

Number 16 on your Feedback card

QRP

Low Power Operation

Michael Bryce
2225 Mayflower NW
Massillon OH 44646

VXO Operation for the Ryan Exciter

Small crystal controller transmitters like the Ryan Communications exciter I described in the April Issue are great fun. Crystal control does have one drawback: You're stuck on one frequency.

At first I was working on a simple VFO for the Ryan exciter. After a few days on the bench, my simple VFO became rather complex. My Ryan exciter is on 30 meters, so the need to have a large amount of frequency swing seemed like overkill. A better, and perhaps even simpler, way to move around the 30 meter band was to swing the crystal's frequency: a VXO.

The Ryan exciter's oscillator will not allow VXO operation as is. I tried several different variable capacitors in series with the crystal and got lackluster results. So, I built a completely new and different oscillator on a small piece of perfboard. I really did not want to make major changes to the Ryan exciter so I built a second board to contain the VXO.

A VXO Oscillator

The oscillator is broadbanded, thanks to T1. A 2N5179 will develop more than enough umph to drive the Ryan exciter. If you don't have a 2N5179, a metal case 2N2222A will work fine, too. The output of Q1 goes to the broadbanded transformer T1. The primary of T1 consists of 20 turns of #26 enamel wire on an FT-37-43 core. The center tap is at 13 turns from the collector end of T1. The secondary has four turns of #26 wound over the entire core. Don't bunch this secondary winding up on one end of the core; Instead, spread the turns over the entire core.

The resistors on the output of T1 place a slight load on the oscillator. A 0.01 µF capacitor couples the output from the oscillator into the Ryan exciter.

You can use any variable capacitor for C1 as long as you don't go over 50 pF.

Use a good quality capacitor for C1 as you'll be running it back and forth through its range a great deal. A double bearing capacitor would be grand, but they are kind of hard to find. Check with KA7QJY Components (P.O. Box 7970, Jackson WY 83001) for his list of variable capacitors.

The crystal used for the VXO should be a fundamental crystal In an HC-25/U holder with a parallel resonance of 20 or 30 pF. Don't get high tolerance crystals, either. A tolerance of 0.01% is fine for the VXO. Crystals mounted in the FT-43 holders don't work well with VXO circuits.

Making It Work

There are two methods of getting the oscillator to talk to the Ryan exciter. Either one will work, and both require some changes or additional circuitry to accomplish.

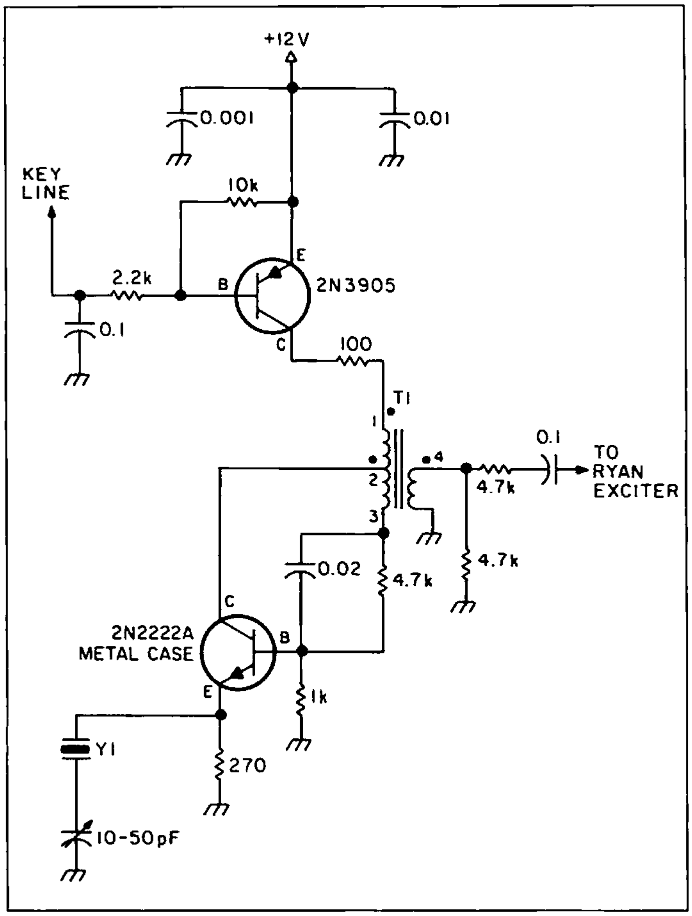


Figure 1. Schematic to allow VXO operation. T1: 20 turns of #26 enamel wire on FT-37-43. Tap 13 turns from the collector end; secondary 4 turns over primary. Y1: Fundamental HC-25/U; parallel resonance; 20-32 pF load capacitance.

The best method is to rework the crystal oscillator of the Ryan exciter to work with the new oscillator. I tried to couple the new oscillator into the base of the Ryan oscillator. This will work if you're really into milliwatting—I was only able to get about 300 milliwatts from the exciter.

To get full exciter output, you'll need to change some components in the Ryan oscillator. The first step is to change the 820k resistor on the base of the oscillator transistor, 2N4124, to 10k. Remove the 270 pF capacitor from the base of this transistor, too. These two changes make the oscillator on the Ryan exciter into a buffer/amplifier. You can still key the exciter as usual by grounding the emitter of the 2N4124. Connected this way, the output of our VXO, coupled to the base of the 2N4124 on the Ryan exciter, will provide operation exactly like a crystal-controlled exciter.

There Is one catch to running the VXO and Ryan exciter this way. You have to keep the external VXO running all the time. You key the Ryan exciter by grounding the emitter lead of the 2N4124. This normally keys the crystal oscillator. Since we've changed the oscillator into an amplifier, the external VXO must run continuously. There are two fixes to this problem. First, just key the Ryan as usual, leave the VXO oscillator running all the time and remove power to it during receive. Or, you can short the key line on the Ryan exciter and key the VXO. To key the VXO, you'll need to add a keying transistor in series with the Vcc line. A simple 2N3905 will fit the bill here. I went a bit overboard and used a 2N4037 to key the VXO.

Since you may have to add the keying transistor to the VXO oscillator, you can then use a second method of coupling the output of the VXO into the Ryan exciter without swapping out parts. Simply couple the output of our VXO oscillator into the Ryan exciter, directly to the driver transistor. Add the VXO drive directly to the base of the 2N5089 driver on the Ryan exciter. When you do this, you must key the VXO as the driver will amplify whatever it sees and pass it to the final. You can key the VXO oscillator and not have to mess with the Ryan exciter, except for one shielded cable from the VXO.

Add a Buffer Amplifier

Because you'll not only have the benefit of the extra stage of buffering between the VXO oscillator and the driver stage, you may want to add a small buffer amplifier. I have not tried this but it would not be a bad Idea. The schematic shows such a circuit taken directly from the *QRP Handbook* published by the ARRL.

This is an easy project to build on perfboard. I didn't make a PC board for it. Just keep the lead length short and direct. Test each circuit before you start on the second one. Be sure you have the Ryan exciter running on a crystal before you start removing parts from its circuit board. Remember, when your soldering iron hits the PC board of the Ryan exciter, the warranty goes up in smoke.

There you have it: VXO operation for the Ryan exciter. This will really bring out the QRP bug now that you are no longer rock-bound.

Number 17 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2"x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 924-9343 data bits, no parity, 1 stop bit. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: Manual for a Kintel 321 Volt Calibrator that I can buy or copy. *Erv Sly W6TKJ, 1053 Camino Caballo, Nipomo CA 93444.*

CLOSED CAPTION CHALLENGE Wanted: Instructions on how to turn off the Closed-Caption Feature on a ZENITH SENTRY-2 Color Monitor, Model: J1324W, S/N: 121-23471074. This model wasn't supposed to have the Closed Caption, but it was hidden away on an all-purpose Integrated-Circuit Chip and got turned on by mistake. ZENITH won't tell me how to turn it off. Help! *Pat W. Kearney, 740 Belinda Ave., Barstow CA 92311.*

Wanted: Schematics or Instruction Manuals for: Model B24 Mini Products Beam Antenna. Model RK3 Mini Products Kit for B24. Will pay for reasonable copying and shipping costs. *Elmer Roth N0BUC, 118 Elizabeth Drive, Aberdeen SD 57401.*

We recently started a new fun project—a photo album of "Radio Cats." We are asking Hams/SWLS all over the world to send us picture(s) of their cat(s) along with name(s) and a short bio for each cat. Names and calls of all family members should be included. *Janis Cameron VE7AAP and Garry Cameron VE7ACM, 3528 11th Ave., Port Alberni BC V9Y 4Y7.*

SOS from Russia. We are the members of children's radioclub "Signal", founded In 1981 in Naberezhyne Chelny. We had a one valve transceiver UW3DI.

Now In Perestroyka's time, the State has abandoned us. Our old transceiver is broken. If the club won't work, they will take away our premise. Transceivers PA, ANT, and other equipment are not produced in the USSR. We are in need of transceiver PA and ANT. We can't make a transceiver because we don't have radio components or the experience. The transceiver can be old but reliable. We can't pay for the transceiver but will make you an honorary sponsor of our club. *UZ4PZC.*

Wanted: Schematic, op. manual, instruction manual for a Heathkit CW transceiver model HW-16, also anything on the VFO for the same rig. I will gladly pay any copy cost and postage. *Lyle Goheen N7VUE, 4316 N. 34th Drive, Phoenix AZ 85017. (602) 242-9490.*

Wanted: Information to repair a Wilson WE-800 2m FM transceiver. If you have a Schematic or manual for the WE-800, I would like to hear from you. *Jeff Harvey VE1BLL, 7 Birchdale Av., Dartmouth, NS CANADA B2X 1E6.*

Wanted: Schematic and/or manual for B & K model 1470 Precision Oscilloscope. I can copy and return same or will pay all costs. *Paul C. Bernhardt WD4EBA, 5553 Jamaica Rd. Coco FL 32927.*

Wanted: Schematic and/or manual for Regency model XL2000 VHF FM Transceiver. I can copy and return same or will pay all costs. *Paul C. Bernhardt WD4EBA, 5553 Jamaica Rd., Cocoa FL 32927.*

Wanted: Donation Contributions of amateur radio equipment from associated radio sale. Yaesu USA Cerritos, CA radio sale any kind of HF, UHF, or VHF radio equipment that can be used to homebrew 15 meter band. Phone or CW Rec this reference to KA1WWC, WOM W6ASI, PA4, KKN3Q, N4PGJ amateur radio nets TNX FB, W2NSD/1. *MacArthur Herman Moore KA3LLY, 5230 Heston St., Philadelphia PA 19131.*

Number 18 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

Microwave Circuits Designed From PUFF

Last month we went into the application programs necessary to set up PUFF and get it running. I wanted to establish an easy path to get PUFF up and running for the first time, compared to the start-up experiences both Kerry N6IZW and I encountered. After a little use this is all elementary, but in the beginning it can be a little defeating.

In addition to basic design, I want to cover the features needed to complete the amplifier circuitry. This includes the positioning of feed resistors, bypass capacitors and the actual location of the RFC feedlines to our stripline circuitry. The final product will cover the complete design for the device N6IZW and I picked to use, an NEC04583 GaAsFET. The design was for 10 GHz operation.

In the design as covered last month the striplines for both input and output networks were designed using the component sweep portion of PUFF. These parameters determine the exact dimensions for the striplines at the frequency specified. At this point, the circuit has matching stubs on both input and output striplines, as well as connections (in PUFF) to connector 1 and 2 as shown on PUFF's screen (F1). What is needed to make this a complete circuit is the DC feed RFCs' and bypass capacitors' connections, as well as the DC isolation capacitors on the input/output of the amplifier.

After all these items have been added, the final step is to add the ground foil covering most of the edge of the circuit board area. A note of caution: After the ground foil is added to the circuit artwork in (F1), do not run any plotting of parameters because that can cause the program to hang or lock up your computer. I guess what is happening is that there are so many unrelated items in the artwork PUFF gets confused. The program will not hang when plotting parameters with the RFC circuitry or bypass capacitors added to the circuit. This can be quite useful for seeing if your added components have any effect on the design. When you have completed your design, save the basic file before doing ground foil operations. Then save the final ground foil circuit in a different file name for artwork output. That way, if any errors are encountered you can go back and use the previous file.

Let's start with the RFC (RF choke) for the amplifier and cover how PUFF operates with RF chokes. We found a small error in the length of the RFC when specifying a 90 degree (quarter wavelength) long RFC. The program gave you a 90 degree RFC but its final length was not 90 degrees but actually something shorter. (The irregularity we noticed was that PUFF calculated the 90 degree line OK but when we placed it on the PC board it was positioned from the center of the stripline to the center of the connecting pad for DC bias. This made the actual length of this RFC something less that 90 degrees in actual artwork generation.)

The remedy for this problem is to make the RFC longer by half the width in electrical degrees of both the stripline and the connecting pad width. This would be an actual length of about 120 electrical degrees, making the actual RFC length much closer to a quarter wavelength long and a better RFC. Both short and normal RFC functioned quite well in actual use, the longer (pure 90 degrees) acting slightly better.

A stripline 90 degrees long at our frequency of interest is the same as a quarter wavelength of transmission line and presents a high impedance to the RF frequency. We make the resistance of this line in PUFF 140 ohms and it functions well as an RFC.

A new part is added to the parts list which is a t-line of zero ohms impedance and 1mm wide. This gives a space in which to place the input and output coupling capacitors on the stripline. To put these in the circuit, go to the end of the circuit and erase the connection to the connector by doing a "shift #" (either a 1 or 2) for the input or output connection. Then place the break on the stripline ends for our capacitor and reconnect the other end to the I/O connectors.

Placing the RFC on the board can require a little juggling. If you want the RFC to be at the input or output of the stripline it's no problem, but usually we want them placed somewhere mid-position on the stripline. To do this we have to reassign a fractional value for our input or output stripline and construct it back together with the fractional components equal to the original single part. In this way we can now go to any of the transitions between parts and place an RFC at those junctions. This involves lots of juggling, but it's not bad at all compared to making artwork on a CAD system with all its complexities.

At the bottom of the RFC t-line we can again connect striplines left and right for the DC bias feeds and bypass capacitors to ground. Don't forget to use another zero ohm 1mm break in the DC capacitor coupling point, the same as in the input output circuitry description for the coupling capacitor.

When all this is done you can define another short section of transmission line to be used in making the ground perimeter and bypass capacitor grounding terminations. This part of the circuit should be done on a copy of your near final circuitry. As I stated earlier, if you attempt a plot your computer will hang up and that will be that. Save copies and use them and if you encounter problems as the design progresses; you can always retreat back to the previous saved copy, saving you from any error.

10 GHz Amplifier Applications

The first project use of the amplifiers constructed to test the performance of PUFF and actual operation compared quite well. Kerry N6IZW constructed and tested a unique antenna system to serve as a microwave repeater for both SSB and WBFM at 10 GHz. Preliminary tests show that this system worked quite well and proved the reliability of the amplifier design to be used in our 10 GHz repeater.

First, a little about the "repeater." This repeater is not standard in that it consists of only an amplifier and two antennas. The design for this system was the inspiration of Kerry N6IZW who has worked at this method by first demonstrating it on a spectrum analyzer on his workbench. Bench tests showed that about 60 to 80 dB of isolation could be obtained between two omni slot antennas for 10 GHz placed on opposite ends of an eight-foot section of standard waveguide. One antenna is pointing upwards and the other antenna is pointed downwards. At one antenna an amplifier with 50 to 60 dB of gain is inserted between the two slot antennas separated by the waveguide section. See Figure 1 for details.

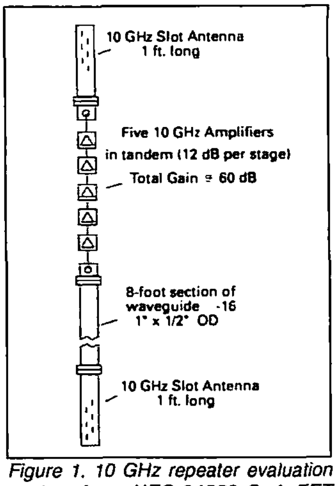


Figure 1. 10 GHz repeater evaluation system for a NEC-04583 GaAsFET amplifier.

The amplifier consists of four each of the amplifiers that we designed and built using the PUFF program. The devices we used were the same NEC-04583 GaAsFET devices as shown in the examples (10 dB per stage and about a 1-2 dB noise figure, hopefully—we haven't measured them yet). The amplifiers that we constructed worked well and reflect very well on the PUFF design program. Measured results compared quite closely to PUFF's prediction of 11 dB per stage. Kerry was able to obtain about 18 dB of gain per stage with custom adjustments with very small copper "snowflakes." These were attached to a toothpick and used to position the copper pieces (about 25 to 50 thousandths square) on the printed circuit board to tune the amplifier for maximum gain. At the 18 dB gain level the amplifier started to break into oscillations and was very unstable. Reducing the single stage gain to the 10—12 dB limits allowed the stable design needed to facilitate packaging it into a housing.

The amplifiers Kerry constructed were wrapped on the edges with 1/2-inch-wide, 0.025-inch-thick copper flashing to form the case sides, and very short grounding for the amplifier edge ground connections. Copper sheeting about 0.008 inch thick was used to form a case cover. The ground foil side of the amplifier formed the bottom of the amplifier. Both sides of the printed circuit board ground foil were soldered to the copper flashing and form a very solid case for the PC board, as well as for feed-through capacitors for power and the coaxial connectors.

Let's get back to the 10 GHz repeater concept. The amplifiers just described were connected in tandem—that's four amplifiers in series providing about 40 dB of gain. The final, fifth amplifier, a broadband commercial unit capable of another 10 to 15 dB of gain with a maximum of +20 dB output, was used to drive the output omnidirectional antenna. The total stack of amplifiers provided gain slightly better than 65 dB.

The System Test

Testing the system proved quite interesting and was planned for our annual Christmas party and white elephant gift giving session. The test: I held aloft the antenna structure which was mounted on a 10-foot section of 2 x 4. Don WD6FWE operated the 12-volt battery feeding the amplifier repeater. Kerry set up a low power transceiver operating at 10.368 GHz, using a 10 dB horn antenna pointing out of his garage. Ed W6OYJ operated portable and moved a couple of houses away and pointed his small horn in the 90 degree path offset from Kerry's transmitter beam.

They communicated with just barely marginal signals received on both ends of this short low power test path, about S-1 to S-2 signals. Then the battery power was turned on to the 10 GHz amplifier repeater for a test. Both Kerry's and Ed's rigs were in direct sight of the repeater antenna and out of sight of each other. With the power on the repeater, Kerry reported an improvement in Ed W6OYJ's signal. As a matter of fact, the improvement was four S-units on Kerry's HT. Ed reported about the same improvement on Kerry's transmission. The repeater worked quite well on its maiden flight.

Power to the amplifier repeater was interrupted several times to confirm operation through the amplifier (not attributed to other sources). Each time power was interrupted signals

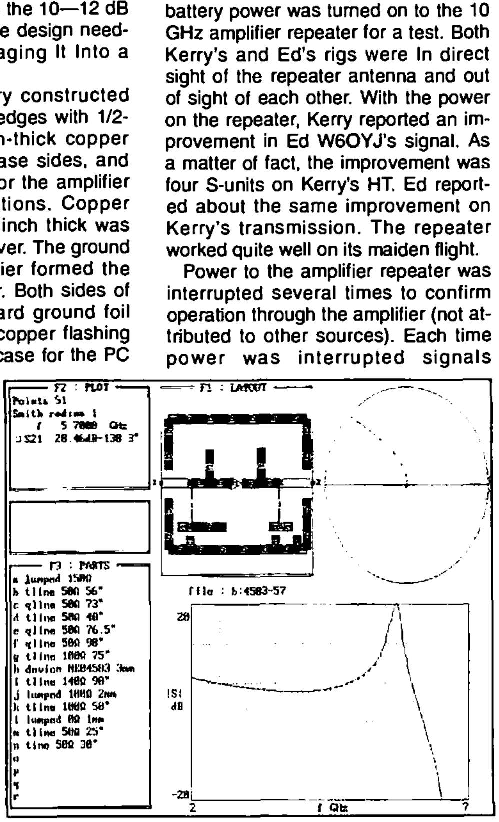


Figure 2. 5760 MHz amplifier design.

dropped to their previous levels of just perceptible and low readings on the S-meter.

Some of you may wonder why we started such a project instead of using a crossband type repeater similar to many of the satellite systems (translators) used before. Well, if this method proves out with further testing and much greater distances involved, we will lift the veil of 10 GHz communications obstacles such as small hilltops and such. A further benefit is that both wideband FM and SSB will both work on this type of amplifier repeater as it is dealing with bulk frequency input output and not mode of transmission. Frequency will be limited to amateur band transmission of course by the addition of suitable filters to remove the possibility of repeating out-of-band transmitters. I will keep you informed on the progress of this system. This is just a method of experimentation that is hopefully going to continue to perk interest in our 10 GHz microwave bands.

What this project has provided is a test of the amplifiers that were constructed under the PUFF design constraints. In the above test it was shown that the amplifiers were very stable and could be operated in concert with each other in the tandem approach needed for the direct-feed antenna that Kerry N6IZW constructed and tested. Some of the early amplifiers were coupled with directional couplers to help stabilize the amplifier string. It remains to be seen if this repeater concept proves to be of greater benefit. The repeater functioned, but better yet it proved the individual amplifiers constructed with the PUFF program. I can't rave on enough about this program—the more I use it the more it delivers high quality performance.

I will provide artwork for the test amplifiers we constructed for the 5.6 GHz and the 10.368 GHz bands for your consideration. These are tried and tested amplifiers, and are shown in Figures 2 and 3 respectively. Please be aware that there might be some aberrations to the artwork due to photograph reproduction and printing irregularities making the final dimensions shown off scale by a small percent.

Mail Box

I received a letter from Ken Stovaf K2MPD on adjusting a Frequency West brick oscillator to the amateur portion of the band. Well, that's no problem and I can do it for you as long as the adjusting filter screws are not stuck or suffering from some other problem. Please include the IF frequency you intend to use so it can be set up properly. In Ken's case, he wanted 10 GHz operation on 10368 GHz SSB with a 144 MHz transceiver. The crystal frequency he selected was 94.666666 MHz to operate the brick oscillator on the 108th harmonic, or 10224 MHz. That's 10368 MHz minus 144 MHz (IF) = 10224. This will work just fine, but with the IF system operating on 144 MHz I suspect that there is no room for error on other stations frequently used for 10368 MHz. This system is capable of upwards frequency swing but not downwards. If errors are detected on communications, the stations in question will have to move up in frequency to accommodate operation.

Ken states that the 144 MHz IF system is used by a group of about eight amateurs in the New Jersey area and that all of them have experienced some trouble with the local oscillator for their SSB systems. That's the reason he wants to use the Frequency West brick to overcome this problem. They lost access to a spectrum analyzer and this made adjusting the bricks filter a lot more difficult. With an analyzer most bricks can be adjusted in about an hour or less in most cases.

The 144 MHz IF will work well; I just wanted to point out a possible weak link in frequency shift. I use a local oscillator frequency of 10223 MHz, one MHz lower in frequency that the above example. This makes an IF frequency of 145 MHz, giving maximum frequency adjustment possible on the IF to correct for any error encountered. In this case the crystal frequency for a Frequency West brick was selected to be 100.2254902 MHz times a multiple of the 102nd harmonic to equal 10223 MHz. We find this system to work quite well at this multiple and IF frequency arrangement.

A further benefit is that crystals over long periods of time age downward in frequency. I have a crystal that is about three years old and will no longer oscillate in the Frequency West bricks circuitry at its stated frequency. I have to reset the crystal 2.5 kHz low in frequency to maintain activity. This means that at 10 GHz the frequency is now about 250 kHz low also. I corrected for this by raising my IF frequency accordingly to 145.250 kHz. If you know where your local oscillator frequency is, an IF correction will put you back on the proper RF frequency. This method will work well as long as you are not into high stability work. Our microwave group designed a stabilizer circuit to work with on frequency crystals at 100.2254902 MHz (10223 MHz LO output). For this application, the crystal must be on frequency and can't have accuracy problems. More on that in another column.

I will be glad to answer your questions regarding microwave or other related questions. For a prompt answer please include an SASE.

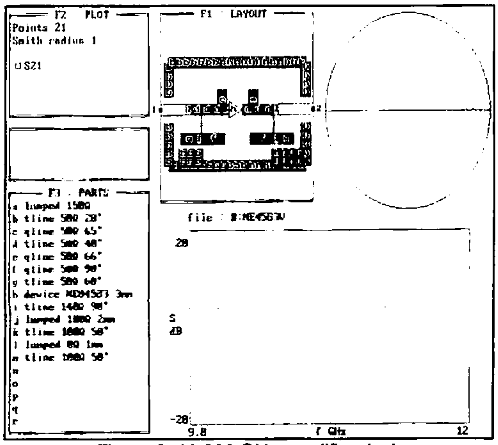


Figure 3. 10.368 GHz amplifier design.

Number 19 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Boy, is it great being in the Space Age! And just think, the amateurs of the world have a chance to make contact with amateurs in space on the Mir *orbiting platform, and also during the space shuttle flights of the U.S., both using the 2 meter downlink frequency of 145.550 MHz.*

The primary difference between the two operating procedures is that Mir *uses simplex on 145.55 for its voice and packet communications and the space shuttle will use duplex operation for voice communication, earth-bound users uplinking on either 144.91, 95, or 97, and receiving on 145.55.*

You might ask, why am I bringing up this subject in this column? One reason, and maybe the primary one, is that I was one of the ones lucky enough to have had voice contact with the space shuttle Atlantis *(STS-45) when it orbited the earth in March and April. The QSO was very short, if you could even call it a QSO, but I was able to listen in on a few of its scheduled contacts with schools and other organizations as it passed over the northeastern part of the United States.*

I have also made contact with Mir's *packet personal message system to leave a message for 73's fearless managing editor, Bill Brown WB8ELK, using only a handie-talkie for power feeding a quarter-wave ground plane made out of a coat hanger with hi-loss feedline. Not the most efficient way of making the contact, but it worked. Don't put down the power of a handie-talkie and home-brew antennas! I'm sorry that Bill did not get the message (room had to be made for newer messages) before he made contact himself. I have even heard of hams using* Mir *as a digipeater to make more distant contacts on packet. Of course it is only as good as both stations being able to SEE* Mir *at the same time, and that time is very limited, of course.*

Secondly, I bring the subject up to highlight how small our world really is. These orbiting platforms circle the earth every 90 minutes or so, depending on the orbit altitude, and every orbit covers a slightly different path over the surface. Everyone with a radio capable of receiving 145.55 MHz has a chance to at least hear these amateurs in space.

And lastly, to again highlight that the non-military space shuttle communications are rebroadcast on amateur radio frequencies. This service is provided by several organizations in the United States. I am most familiar with the WA3NAN rebroadcasts from the Goddard Space Flight Center in Greenbelt, Maryland, because I listen to them when I can. I am not attempting to slight any of the other rebroadcasters. I just hope that ALL people have a chance to hear just how much scientific data is being gathered on these missions and that even though these missions are very expensive, you and I may have a chance to benefit from this knowledge in the future.

—Arnie N1BAC

Roundup

Japan From the JARL News: JARL's General Assembly is scheduled for May 24th at Ise City in Mie Prefecture (JA2 area). This will be one of the JARL's most important annual meetings inasmuch as it is the time when the budget will be discussed and decided upon by members gathered throughout Japan. Additionally, various programs and activities for the year will likewise be outlined and scheduled.

The event will be a first for Ise City, famed for its historic Ise Shrine and Toba, reputed for cultured pearls. Hence it is of no surprise to learn that the Assembly has come to be known as the "Pearl Assembly" and the design of the symbol mark depicts none other than a young lady pearl diver.

Following are some of the events scheduled: operation of a special station with a commemorative callsign "JA2RL" will go on the air to make known the existence of the meeting; a display of the newest amateur radio equipment by the Japan Amateur Radio Industries Association (JAIA); junk market and a number of other attractions that are in the planning stages.

Ham Fair '92

This year's Ham Fair '92 has all the earmarks of being a G-R-E-A-T Fair! We urge you therefore to mark the dates August 21 to 23 on your calendar. It will, as in previous years, be held in the New Hall of the Tokyo International Trade Center in Harumi, and it is reputed to be the largest show of this kind.

Last year the event attracted as many as 60,000 visitors, including visitors from no less than 17 foreign countries. We hope for many more this year. The catch phrase for this year is: "Land of Amateurs," with "Rediscover the Pleasures of Ham Radio" as the theme.

Secretary General of ARI Visits JARL

Mr. Mario Ambocci I2MQP, Secretary General of Italian Amateur Radio League (Associazione Radioamatori Italiani, ARI), who participated in the operation of ZA1A in Albania at the time of its opening last September, visited the JARL office in Sugamo, Tokyo, in the latter half of January 1992.

A special plaque symbolizing friendship between ARI and JARL was personally handed over to JARL's Secretary General, Mr. M. Kumagai JJ1WUC, who expressed appreciation at this thoughtful gesture. Later, under the guidance of Mr. Arisaka JA1HQG, Mr. Ambocci was shown around the exhibition room and the JAS-1b (FO-20) control room. Mr. Ambocci operated AZ1A with Mr. Arisaka when they were both in Albania last year.

Scotland *From John "Paddy" McGill*: Continuing information from the Scottish Tourist Board (Radio Amateur) Expedition Group, June 20/21; GB8GC, Glamis Castle, Angus. A Royal Residence since 1372, family home of the Earls of Strathmore and Kinghorne. *[Check the May issue for frequencies and times. Otherwise, download the whole thing from the 73 BBS.—Arnie]*

Switzerland *From the International Telecommunication Union (ITU) Press Release*: The World Administrative Radio Conference (WARC 92), which was meeting for a little over four weeks at Torremolinos, Spain, closed with the signature of the Final Acts in the night of March 3, 1992. The Conference was attended by more that 1,400 delegates from 127 countries of the ITU's 166 Members and by observers from 31 international and regional organizations.

HF (Short-wave Broadcasting) Additional frequencies were allocated on a worldwide basis, subject to planning, reserved for single-sideband emissions and will become available for broadcasting on 1 April 2007 (shared usage). In respect of single-sideband techniques, a Recommendation on the introduction of SSB was agreed. The Recommendation invites the ITU Administrative Council to place on the agenda of the next WARC the request of WARC 92 to consider the possibility of advancing by as much as possible the date of 31 December 2015 for the general introduction of SSB and the cessation of double-sideband in all bands. The Recommendation recalls that some administrations have recommended advancing the date by up to 10 years. *[This only impacts HF Commercial Broadcasting interests, but would knock down the carriers of double-sideband on shared frequencies.—Arnie]*

Amateur Service Given the fact that no spectrum was freed by WARC 92 in the 7 MHz band, a further worldwide allocation to the amateur service in this band was not considered possible. A Recommendation (COM4/C) was therefore adopted inviting a future WARC to consider the possibility of

Photo A. Photo of UC2AAA and friends on Snake Island. 1st row (L-R): RB5FF, RB5ZM, RO4OE, RB5FT. 2nd row (L-R): UB4FA, UC2AAA, UB5FBV, RC2AR.


Photo B. VHF antennas were mounted on a coastal machine-gun turntable. UC2AAA at left.

Photo C. "Antenna Farm" on Snake Island

aligning the allocations to the amateur and broadcasting services around 7 MHz so as to provide a worldwide allocation. *[It looks like we live with the shared use of the 40 meter band for at least another 23* ***YEARS*** *(the next WARC is scheduled for 31 December 2015).—Arnie]*

Wind Profiler Radars Furthermore, a Recommendation (GT-PLEN/A) concerning the study, by the CCIR, of the characteristics and requirements of wind profiler radars was approved with a view to allocating appropriate frequency bands around 50, 400, 1,000 MHz. Wind profiler radars are used by meteorological services to measure wind direction and speed as a function of the altitude. The information is vital for the safety of air navigation, particularly at the time of landing; the absence of such information might have had an impact on several aircraft crashes in the past. The Recommendation also invites the ITU Administrative Council to include on the agenda of a future WARC the question of appropriate frequency allocations for the operational use of wind profiler radars. *[In the United States, even though the wind profiler system has been tested around 400 MHz, the FCC has already taken the "bull by the horns" and has decided to use 449.0 MHz +/- ? MHz or so, as the frequency spectrum to use, thus impacting our use of amateur repeaters in the same shared spectrum. At the moment it is only in certain areas, BUT, what will happen in the future? Are the U.S. hams losing more spectrum without replacement frequencies? Maybe so!—Arnie]*

Belarus *From a letter from Dr. Valery Pristavko UC2AAA:* "Buy A Piece Of The Rock?" was one of the topics related by "Larry" in his letter to Wayne. He enclosed a few photos taken by him on a visit to Snake Island in the Black Sea (N45-15.38, E30-12.3). One day while Larry was there the Commandante of the Island remarked, "I was told that you guys are willing to buy this isle. Do it, PLEASE!" *[In the pictures you can see that the island does have a very unique antenna farm!—Arnie]*

Larry asks that we mention an independent QSL Bureau for the ex-USSR with no charges for incoming mail. It is "QSL CHERNOBYL, Box 17, 220012 Minsk, BELARUS."

[A little sidelight from the letter: Larry remarks that his correspondence with Wayne many years ago was noted by the members of the KGB and he had a chance to know the KGB's opinion of Wayne. Larry was told, "He is a fine example of a young American Capitalist, willing to expand its empire." Does that sound like Wayne?—Arnie]

BULGARIA

Milen Postadshieff LZ2MP
P.O. Box 237
7000 Russe
Bulgaria
Packet: LZ2MP @ HB9AK.CHE.EU
LZ2MP @ DKICENI/0MTV.DEU.EU

First, thanks for the replies from some of the *73* readers, which included KC1YR, KB8AOB, N5VGC, WA8FLF, and GØNEE. Based on the feedback of a questionnaire, I am providing some background on ham radio in Bulgaria for this issue and will provide some information on the digital modes in Bulgaria in the future.

Ham Radio in Bulgaria

To understand the ham radio activity from Bulgaria better, one has to bear in mind that the average salary for one month is about $50US. That is why most of the private stations here are running home-brew setups. According to the last LZ callbook, there are about 1,200 ham radio stations in Bulgaria, but I think about 400 of them may have working SSB/CW equipment. For example, here in Russe, the fourth largest LZ city with about 300,000 inhabitants, there are about 30 ham radio stations listed. But only seven or eight of them have working equipment and are active. Also, there are only two 2 meter FM setups. Therefore, the ham activity from here is concentrated in the LZ Radio Clubs.

You can recognize these clubs from their three-letter suffix calls starting with a "K" for club, e.g. LZ2KIM. Most of the clubs are so-called "city clubs" where all local hams are united. There are also ham radio clubs at some schools, universities, factories, etc., Depending on the main interest of the members, some of the clubs are contest, fox hunting, digital modes, etc.

oriented. Sponsored by factories, companies, universities and schools, during the last 10 years almost all clubs managed to obtain factory-built equipment. Most of the transceivers are Kenwood TS-830s and the computers are Apple II compatibles. So the main reason that ham radio activity is concentrated in the radio clubs is that almost all of them are well equipped compared to private stations. Another reason the ham radio activity is concentrated at the clubs is that they are manned by paid station managers.

Licenses

In Bulgaria, amateur radio activity is governed by the Ministry of Communications. There are three levels of amateur licenses, called respectively C, B, and A. The licenses for C level are issued by the local radio club. All C license holders can operate with up to 50 watts input on 80, 40, and 2 meters and above. The licenses for B and A level are issued by the Ministry of Communications. Holders of B licenses may operate all bands with up to 250 watts while all A licenses holders may do that running up to 1 kW input.

The examinations for all licenses cover four main areas: some LZ/ITU/IARU rules and regulations, radio theory, on-the-air operating skills and an optional Morse code test. The only restriction for the no-code license is that holders are not allowed to operate CW. After passing the exams and getting the license, one may apply for permission to install a private station and get a callsign. There are lots of hams who have passed the exams but are not able to build or buy equipment, so they are allowed to operate from any club station using the club callsign. All club stations have three-letter suffixes against the two-letter suffix of the private stations. All stations with odd numbers in the prefix are located in the southern part of Bulgaria and even numbers are in the northern part. The only exception are some contest callsigns with one letter in the suffix only.

One last item for this issue: The LZ DX Contest will be held on the first Sunday in September, from 0000 to 2400 UTC. It will be CW only on 3510-3560, 7000-7040, 14000-14060, 21000-21080, and 28000-28100 kHz. Logs should be sent to Central Radio Club, PO Box 830, Sofia 1000, Bulgaria. *[Further information may be obtained on the LZ DX Contest and other Awards on the 73 BBS.—Arnie]* 73 de Milen LZ2MP.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
Packet: 4X1MK @ 4X4SV.iSR.EUI

Code-Free Comes to Israel

The Israel Ministry of Communications has announced the inception of a new license category. Called the Technical Class, there is no Morse requirement.

An excerpt (freely translated here) from a memorandum circulated by the Ministry of Communications clearly explains why this new license class has been introduced: "In light of the fact that in the European countries and even in the United States a new license grade (Technical Class) has been implemented, in which there is no demand to be examined in Morse (transmitting and receiving), the representatives of the Israel Amateur Radio Club (IARC) requested the establishment of a similar license class in the State of Israel as well."

The technical examination is the same as the Grade "B" (General) test, plus additional questions dealing with new technologies. Thus, instead of Morse proficiency, the examinee will have to demonstrate some knowledge of digital communications, computer structure, operation and interfacing, satellite communications, and orbiting mechanics.

The Technical Class licensee will have the same privileges as the Grade "B" (General) holder on the frequencies above 30 MHz. The first examinations should be held in April 1992, and it still remains to be seen what new callsign prefix will be assigned to the "Techs."

As in other countries, a debate on the no-code has gone on both over the airwaves and on the pages of *HaGal*, the magazine of the IARC. Although some hams will continue to strongly express their opinions on the subject, the matter has been practically settled. But now those poor souls who claimed that Morse was an insurmountable barrier to their gaining a ham license have no further excuse!

Last time, I reported on the authorizations of autopatches for emergency use only for contacting police, firefighters, and ambulance services. Now, the Ministry has stated that it intends in the future to allow full autopatching, but for Grade "A" (Advanced-Extra) license holders alone. You may recall that only Grade "A"s are permitted to use phone patches in their stations.

In the same circular, the Ministry of Communications said that they have invited a representative of the IARC to participate in their deliberations to decide the Israeli position with regard to frequency allocations in the World Administrative Radio Conference (WARC 92) coming up this year. The Ministry representatives have stated in the past that the Israeli delegation to WARC 92 will act favourably to protect amateur radio interests.

There is talk of widening the amateur allocation on the 6 meter band, which is presently here a mere sliver from 50.100 to 50.150 MHz, and at present for the Grade "A"s alone. Policy on this matter will be set in deliberations with the IARC and the government agencies that are the primary users of this part of the spectrum. In the meantime, 6 meter DXers worldwide should keep an ear open for 4X1IF on the frequency noted previously. ■

Number 20 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Playing the Numbers

It seems as if, every time you turn around, more and more devices are going digital. By now, we hams are very used to frequency synthesizers, memories and digital control ol transceivers. But are our rigs truly "digital"?

Nope. Our radios are really not much different inside than tube rigs of 25 years ago! Oh sure, the frequency generation scheme is quite different, but the signal chain, from antenna to speaker, is much the same as it always was: a front end, mixer, IFs, detector and audio amp. So what's wrong with that?

Nothing, really. But certain very important receiver characteristics, such as selectivity, are limited by the basic nature of analog circuitry. There are better ways to receive signals, and they may be coming to a radio near you, though probably not very soon. For that matter, there are entirely different ways to encode voice information, and they may hold the key to far better audio quality and tremendously reduced QRM. The buzzword of the future is DIGITAL!

Thanks to the incredible compact disc, everybody knows that you can digitize audio, store it, send il, manipulate it and then reconstitute it back to its original analog form. The best part is that no quality need be lost during the journey. Let's take a look at the basics of digital technology. When we're done, we'll explore how it might affect ham radio in the years to come.

No Free Lunch

Analog audio consists of a continuous, changing voltage which follows the original sound pressure waves from whence it came. Any unintentional change to that wavering voltage constitutes distortion. Such change can result from noise, circuit imperfections, QRM, etc.

Digital data consists of sets of numbers represented by electrical "ons" and "offs." Having only two states, the data is easily recovered after passing through noisy, distorted channels. After all, the noise would have to be pretty bad before you might mistake an "on" for an "off"! The small distortions which would ruin an analog signal aren't even noticed with digital data.

Obviously, there's a price. Since, at any given moment, the signal can only describe two states, it holds less information than it would if it were analog. Thus, there are going to have to be lots and lots of numbers flying around if we are going to describe all those subtle changes in the original signal. The result is that digital signals take far more bandwidth than analog. There are ways to reduce the penalty, though, and we'll look at them a little bit later.

All Right, Break It Up

So how do you digitize an analog signal? It's really not that hard. You simply measure the voltage at discrete moments and turn those measurements into digital data. It's kind of like using a digital voltmeter real fast. The result is a series of "samples," each of which tells you what the analog signal's voltage was when you took the measurement. Ah, but what about changes which occur *between* measurements? That's not a trivial matter and is, in fact, central to the whole concept of sampling.

Ny Who?

There was a fellow named Nyquist, and his theory claimed that a signal could be fully described by taking only two measurements per cycle. Thus, in order to properly digitize a signal, the sampling frequency (how often the measurements are made) should be twice the maximum frequency present in the signal. But how can you describe an entire cycle in only two measurements?

Really, you can't. That is, unless the signal is a sine wave! Obviously, if you know the signal is, in fact, a sine wave, and your samples tell you the size and position of the two peaks, you can reconstruct the sine wave quite well. But audio isn't made up of sine waves, so what good is it?

Fourier's A Jolly Good Fellow

According to another fellow, named Fourier, *any* signal can be decomposed into a series of sine waves, with the slowest one being called the "fundamental" and the others being called "harmonics." When added together, point by point, those sine waves will reproduce the signal. No, we don't actually have to do such a thing in order to digitize a wave. The point is this: When a wave has no harmonics, it *must* be a sine wave! If it is any other shape, there will be harmonics. So, if we strip off the harmonics, we've got a sine wave. At or near the upper frequency limit of any system, all you can have are sine waves, because the harmonics are lost above the frequency limit. Thus, if we sample our signal at twice the maximum frequency of any harmonics in it, we can describe the highest harmonics with only two samples because *they must be sine waves anyway.* And if we've described it all the way up to its highest harmonics, we've captured the entire signal! By the way, that's why all those misinformed critics of CDs are wrong when they say that sampling causes you to miss some information in the original music signal. All sampling does is define a *maximum frequency response* for the signal chain. If you sample at 44 kHz, you can accurately describe any signal up to 22 kHz, with absolutely no loss of information. By the way, in a CD player, the filter which follows the signal's reconstruction to analog smoothes those upper-frequency samples back to sine waves for the same reason—it cuts off their harmonics!

Using Your Alias

If you input a frequency which is greater than half the sampling frequency, though, things get strange. Imagine some sine waves. Now imagine that you sample them only once per cycle. If you

reconstruct those samples into voltages, you will see that the result is just a straight line! That doesn't describe the original signal at all, does it? If you sample at say, 1.5 times the signal frequency, it gets even weirder. Try it. Draw a bunch of sine waves and then, using a ruler, pick points on it every 1.5 cycles. Now, connect the dots. What have you got? Garbage! This is called "aliasing," and it sounds terrible. That's why CD players sample a little bit faster than twice the desired 20 kHz input bandwidth; the input and output filters don't have perfectly steep slopes, and keeping the music signals away from the *Nyquist Limit* helps eliminate aliasing.

That's Deep

So now you know what's involved in the "horizontal" aspect of sampling. In other words, how often you have to do it. But, there's a "vertical" aspect as well. The more bits (digital "ons" and "offs") you use in each sample, the more precisely you can describe each voltage measurement. If you only have two bits, you can only describe four possible voltages, because there are only four possible combinations of two bits. They are: 00, 01, 10 and 11. That's not much resolution! If you have 16 bits, though, you can break the measurement into 65,536 parts. (No, I'm not gonna list them all here!!) With that kind of precision, the inherent distortion is reduced to a very tiny fraction of a percent. Of course, that means you have to send lots more bits, so you need lots more bandwidth. A CD player reads about 2 megabits per second off the disc. Not all of that is music, though; some is for the time counter and some is for error correction. But 44.1 kHz times 16 bits times two channels equals over 1.4 megabits per second, so forget sending it over 20 meters, at least in real time!

What's the Point?

Of course, ham communications don't require CD quality. In order to digitize an HF-grade voice signal, we need to take about 6,000 samples per second. Four bits of sample "depth" give us 16 levels of voltage resolution, which will produce listenable speech. Six or eight bits are much better. So, we're still talking about 24,000 to 48,000 bits per second, which is an awful lot. Remember, though, that a bit is not the same thing as a Hz. It is possible to send many bits per second over a limited bandwidth, although it gets tricky if you push it too far. 9600-bits-per-second modems are increasingly common over the telephone and VHF/UHF packet links, but even that is too slow for real-time speech of decent grade. Is there another way out?

Squish

One of the hottest technologies today is data compression. If you use a computer, you may have seen a form of it in the ZIP or ARC programs. These programs compress files into a smaller size. When you decompress them, the original files are reconstructed, with nothing lost. How can that be?

Well, as it turns out, not all the data is really needed. For instance, if your file consists only of text, it does not need all eight bits because there are far fewer than 256 printable characters. Thus, it can be coded to get about 1.5 characters per 8-bit byte, with no data loss. This simple form of data compression is very workable, and there are far more sophisticated systems which can reduce *any* file by an average of 50 percent!

There are other methods of data reduction which are particularly applicable to voice and video data. A great one is "delta modulation." In this scheme, only the *changes* in the incoming analog signal are coded. This works especially well for video because pictures usually contain lots of identical or similar areas. Instead of sending the same byte over and over, the delta modulator simply sends it once: analog with a code telling the demodulator how many times it is to repeat.

A combination of delta modulation and data compression can tremendously reduce the amount of data required to reproduce adequate sound. In fact, Sony's new Minidisc pocket digital recorder reduces the data by 80 percent before recording it! And that's for hi-fi sound. Imagine what we could do with voice-grade signals.

Oops, Missed

One problem with digital encoding is that missing data causes far worse glitches in the reconstructed audio than a similar amount of missing analog information. I know that seems contradictory to the performance of CDs versus LPs (remember those?), but it's true. The problem was recognized early in the development of the disc and solved with a technique we may be able to use. It's called "interleaving."

Spread It Around

On a CD, there's lots of redundant information, along with checksums similar to those used in packet radio. A checksum is simply a number which tells the decoder how many bits there should be if they all are correctly read. Thus, the system knows when something's missing, but not what it is. More sophisticated techniques actually let the decoder fill in and correct some missing information. But still, if a decent chunk gets lost, there's gonna be a nasty noise in the resulting audio. Interleaving is simpler than it sounds. It just means that the data is not recorded sequentially. For example, the first bit of a byte may be followed with the first bit of the next byte. After, say, eight of them, the second bit of the first byte is stored, followed by the second bit of the second byte, and so on. Why do it? Because, by spreading each byte over a larger area of the disc, or a longer span of time over the air, the chances of losing a significant portion of any one byte are tremendously reduced. That's why scratches in a CD don't mess up the sound at all unless they're bad enough to cause the laser to skip an entire track. Of course, it takes longer to retrieve an interleaved byte, so there's a delay between the time you start reading it and the time you can turn it back into analog. On a CD, it doesn't matter, because you don't know and don't care when it was read off the disc.

If we apply the same idea to radio transmission, though, it does matter. A delay of only a quarter of a second should be acceptable, but a one-second delay would make conversations very awkward. On the other hand, the longer the interleave period, the better it works at keeping noise bursts and QRM from destroying the data.

Well, there's more to discuss, but I'm out of room. See you next time.

HOMING IN

Number 21 on your Feedback card

Radio Direction Finding

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Bag Those Foxes: Antenna and Hunt Ideas

What's the fastest growing special interest group in amateur radio? It's hard to say for sure, but it just might be radio direction finding (RDF) contesters. You'll hear them called hidden transmitter hunters, foxhunters, bunny hunters, or simply T-hunters.

Hams learn RDF techniques so they can solve RFI problems or track down jammers and bootleggers, then discover that it's a lot of fun to go mobile DFing just for the sport of it. In the last month, I've heard from newly formed or growing T-hunt groups in El Cajon (CA), Memphis (TN), Dayton (OH), Los Gatos (CA), Amherst (NY), Columbus (OH), and Fremont (CA).

Photo A. If you turn on a hidden transmitter near Bolivar, Missouri, you'll be found in short order. Jim Strader KFOØL and Gary Harrison WAØRWS are ready to hunt.

Traditional mobile VHF T-hunts involve a single well-hidden "hare" and a group of "hound" vehicles trying to find it. To win, they must get there in the shortest time or with the fewest miles traveled, depending on the rules. Usually, all hunters start from a common hilltop, although "start anywhere" is practical for first-finder-wins events.

You don't have to live in a big city to have foxhunt fun. There are only 4,000 households in Bolivar, Missouri, but regular hunt competitions are on the ham club's calendar there. Gary Harrison WAØRWS sent me photos of the 2 meter RDF equipment they use. Hand-rotated strung-wire quads are the antenna of choice (Photo A). They are easy to make from PVC pipe and Fiberglas spreaders.

Rather than drill a hole through the roof of his wagon, Gary came up with a clever window mount using inexpensive PVC pipe (Photo B). It attaches to the roof rack with hose clamps so it's easy to remove after the hunt. He can hunt in almost any weather because he made a Plexiglas panel to fill the void left by the partly open window.

Build or Buy?

Yagis are also popular as T-hunt antennas on 144 MHz and up. Three- to six-element home station models by Cushcraft and KLM have been used with success by hunters in my area. One disadvantage they share is that they aren't made to be quickly disassembled and stored between hunts. That's why I was interested when MFJ Enterprises (P.O. Box 494, Mississippi State, MS 39762; 601-323-5869) announced a new portable three-element beam.

Unlike most VHF yagis, the MFJ-1763 boom is not made of aluminum tubing. It is a long box-like enclosure with threaded inserts to accept the elements. They attach or detach in seconds. Your feedline connects to the SO-239 at the rear. Inside the boom box are a matching capacitor and a ferrite bead balun. The balun gives excellent feedline decoupling for a good pattern, which is important for RDF use.

MFJ uses a chemical film process to protect all the aluminum parts. In my area, outdoor aluminum antennas are pitted and corroded in just a few months by salt air, so it will be interesting to see if the process prevents that from happening to this one.

I mounted the MFJ-1763 atop the van with a PVC pipe mast, just like the other antennas I've tested over the years (Photo C). The feedline goes down the mast, running only 4-1/2 inches from the driven element, but this did not appear to affect the yagi pattern. For regular use, however, it would be better to route the coax down behind the reflector.

The front-to-back ratio was 14 dB, which isn't stellar, but it's adequate. It's the difference between 3/4-scale and near zero on S-meters in most VHF-FM rigs.

The portable yagi is lighter and easier to turn by hand when stopped, compared to my usual four-element quad. But when driving at highway speeds, the boom box makes it "weather vane." Because the mast connection point is behind the driven element, it wanted to point to the rear. It took a lot of force to keep it pointed any other way.

Since successful hunters spend most of the time moving toward the T instead of away from it, I tried to offset this effect by bolting a vertical vane of thin aluminum sheet to the rear of the boom, using the holes provided for rear mast mounting. It took about 20 square inches of material to eliminate the tendency to point backwards.

The acid test for the MFJ-1763 came on the Southern California "Pathfinder" transmitter hunt in March. WA6OPS and I successfully found the T, but we didn't have the lowest mileage. We got fooled by some dead-end streets, but the MFJ beam can't be blamed for that.

Hiders AF6O and KI6FG were 21 air miles away from the starting hilltop, running only a few watts on a rocky power line access road. Because of the wide spacing, the MFJ-1763 has about the same gain as the typical four-element quads that are popular with local hunters. It picked up and tracked this fox just fine.

Free-For-All Contesting

Southern California T-hunters—many of whom believe that the longer a hunt lasts, the more fun it is—have just invented a new way to have a full day of RDF enjoyment.

The Free-For-All (FFA) hunt is unique because each hunting team is also a hiding team. The fun begins early Saturday at a restaurant in the central part of the hunt area. After breakfast, each team leaves to hide its transmitter.

About an hour later, the Southern California coordinated T-hunt frequency (146.565 MHz) comes alive, as one by one the fox-boxes begin their transmissions. After activating its hidden T, each team rushes off to try to be the first to find all the others.

Each of the recent FFA hunts has brought out about a dozen vehicles. Despite the need to deposit their T's quickly so they can start hunting, the teams manage to find challenging spots to place them, usually by scouting in advance of hunt day.

If you think this sounds like fun, your club may want to consider some rules for the hunt, to suit your area and the skills of your local RDFers. You could set up boundaries, limits on transmission duration/timing, and some sort of scoring system.

To the FFA aficionados of Southern California, however, boundaries and rules are unnecessary and a nuisance. The few rules that may be imposed on a particular FFA are made up over coffee on hunt morning. Usually, the only requirement is that each team must hide at least one T before starting to hunt. It should be on the air

Photo B. WAØRWS devised this roof rack mount because the rigid headliner in his wagon eliminated the possibility of a through-roof hole. Note the plastic panel to keep weather out.

within an hour after breakfast. Everything else is unpredictable, and that's the way they like it.

Such an attitude leads some teams to search for opportunities to be outra-

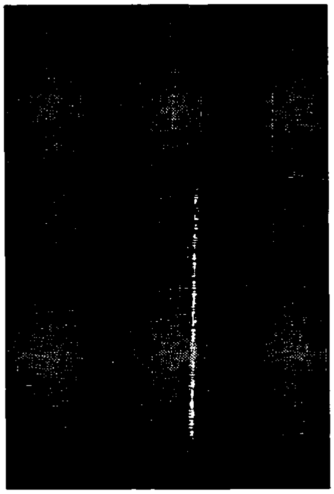

Photo C. I tested the MFJ-1763 yagi with a PVC pipe mast on the T-hunt van. You can have horizontal polarization by using the other set of holes for the U-bolt.

geous. Foxes with packet transmissions and fraction-of-a-second pulses have been used. Some teams hide multiple transmitters, within yards of each other or miles apart. Hiders have used clock-timers on low-power T's at distant mountaintops, timed to start transmitting shortly after breakfast.

Organized Chaos

A dozen T's on one frequency? It's tricky, but practical. Each T beeps for only a few seconds, then it's silent for a minute or so. Hiders program their controllers (see the sidebar) with different on/off ratios, so the transmissions of the various T's are out of sync and "doubles" are random.

Hiders leave clipboards or notebooks near their T's so hunters can sign in as they arrive. The hunt ends

when everyone finds all the transmitters or gives up. Participants stay in contact on the hunt frequency, although most of the things they say are intended to mislead more than to enlighten. Often, the last team to find a particular transmitter is instructed to pick it up and bring it home.

The Southern California FFA hunt is clearly designed for advanced hunters, but some form of FFA hunt might be a refreshing change of pace for your local hunt group. Next time the hunt day approaches and the designated hider can't participate for some reason, announce a Free-For-All instead.

Many clubs around the country have built one fox transmitter or control box to be passed on to the hider before each contest. Before your group can hold a FFA hunt, every team must acquire some sort of controller unit. The sidebar gives information on easy projects.

Thanks to all who have sent in their foxhunt stories and photos. Keep 'em coming. Let's continue to spread the word on the joys of RDF. 73

Join the Free-For-All

It's easy to build a controller to identify and time the emissions of your hidden T. Here are some projects to choose from.

1. The Auto-Fox by WB6GTM sends the T's callsign over and over in MCW. The callsign and on/off times are programmed by setting 64 DIP switches and two pots. It's in *73 Magazine*, August 1985, page 48.

2. The Un-Music Box plays a sequence of tones that repeat every six minutes. Transmissions are continuous or on 15 seconds out of each minute. It IDs in MCW every 10 minutes from a CMOS shift register, easily programmed with three toggle switches. It's on page 193 of *Transmitter Hunting—Radio Direction Finding Simplified* by KØOV and WB6UZZ, published by Tab Books (#2701), available from Uncle Wayne's Bookstore.

3. N6MBR's TBOX features micro-processor control, three-tone patterns, and user-selectable on and off times. MCW ID is sent in every transmission, regardless of length. The built-in firmware is menu-driven from the serial port of your computer. A clock/calendar chip is optional. "Homing In" for October 1991 has the schematic and information on boards and firmware.

Remember that FCC rules require a control operator at the control point of every amateur radio transmitter when it's on the air. This requirement is satisfied if you monitor your foxes and are able to turn them on and off with a UHF control link (See FCC 97.7, 97.105, and 97.213). "Homing In" for December 1990 describes the Fox Controller, which uses an inexpensive UHF pager receiver and simple DTMF remote control circuit to activate and deactivate the T.

Never Say Die

Continued from page 4

were lily white.

Old-timers will remember when Clif Evans published some of the Doyle Letters, exposing the contempt with which the directors held the members and the means by which the ARRL officers totally controlled the elections. These letters made it clear that even then the mind control of the members was well established, and had been since Hiram Percy Maxim ran the outfit in the 1930s. Maxim was not only the founder of the League, but also of a film organization . . . which is probably where he learned about the power of subconscious messages. Maxim was a genius and way ahead of his time.

Do I read *QST*? Oh, I look through it now and then, but then I know the secret for canceling out subliminal messages, so I don't have to worry. How can you tell if you've been reached? Easy, how mad do you get when I seemingly attack the ARRL? Does it bother you when I mention that I hold the ARRL almost totally responsible for the loss of our American consumer electronic industry and for the emergence of Japan as number one in the financial world?

Do you really think it's a total coincidence that the ARRL's Incentive Licensing rule change came at the exact same time as the demise of all our greatest names in radio manufacturing such as Hallicrafters, National, Hammarlund, Millen, Thordarson, Stancor, World Radio, Eldico, Eico, Collins, Central Electronics, Sideband Engineers, Webster, Lakeshore Industries, Lafayette, Johnson, Barker & Williamson, Technical Materiel, Arrow, Clegg, Polytronics, MultiElmac, International Crystal, P&H, Harvey Wells, Telrex, etc.? That's a whopping coincidence, eh?

I have flatly refused to ever let any subliminal ads be run in *73*, even when I had to lose an advertiser in the process . . . like a certain antenna manufacturer I could mention.

How much is your subconscious controlling your life? "No, not me," is the conscious mind response. Sure. So there's nothing that makes you mad, no phobias, no irrational responses. No urge to talk too much . . . or to not talk much? No urge to eat, even when you're not really hungry? No instinctive like or dislike of some people? No fear of heights? No orientation problems? Sure.

Worse, the subconscious mind is not a thinking mind. It's completely reactive. It works on the instructions it's received, not on reason. It accepts as law instructions it's been given, no matter how outlandish. Is it any wonder that almost everyone is "crazy" in some way and to some extent?

Only psychologists trained in tapping into the subconscious and finding these hidden instructions can explain why people do what they do. Only they can explain why people like Jeffrey Dahmer do what they do with any certainty. Is Jeff insane? He certainly acted peculiarly, but this gets to the heart of a touchy legal matter: insanity.

The same subconscious instructions which make us all act oddly are also quite capable of making us sick and killing us. Indeed, at the heart of every disabling illness lies a subconscious root. Even most illnesses tied to genetic weaknesses still need to be triggered into action by the subconscious mind.

It's very simple, once you know how, to get into direct communication with another person's subconscious and not only discover the instructions embedded which are causing troubles and illnesses, but also to erase these instructions. Indeed, it is so simple to find these subconscious instructions that we'll eventually have computer programs able to do it and not even need trained psychologists.

In a few years you'll be seeing computers automatically taking your medical history when you go to a doctor's office . . . and a big part of the information the computer will get is the root subconscious cause for the illness that brought you in. This will allow the doctor to not only treat your symptoms and any germs or viruses at work, but also the underlying psychological trigger.

If we can ever get doctors seriously interested in preventive medicine we may start cleaning up the mess in our subconscious mind which weakens our immune system, triggers genetic weakness problems, causes obsessive behavior, and even helps us to have "accidents."

Meanwhile, how much of your behavior is completely rational? How much seems rational to you, but not to others? And how much is being influenced without your knowledge by subliminal messages?

Did I ever tell you about the radio announcer I worked with who had to give a little cough every time he went on the air? He had to have a switch put in to cut off his mike for these coughs. In therapy we found the instruction deeply embedded by his mother. It said, "Every time I get nervous I have to cough." Once I found the instruction in his subconscious and erased it, he never coughed again.

During my years as a professional psychologist I never found any patients without subconscious instructions that were bedeviling their lives. The process for discovering and erasing all this baloney in our subconscious minds isn't complicated, it's just that I don't know of any psychologist who knows how to do it. The main problem is that this approach cures people of almost anything in a few hours instead of taking years, so there's no way to make much money with it.

Isn't it a bit frustrating to know that you are being run like a puppet by your subconscious mind, blindly and unknowingly obeying long ago installed instructions . . . and perhaps endless subliminal messages?

Now let's see, were's my *QST*, so I can flip through and see what they're up to this month. Heh.

How To Get What You Want

"Oh. I just haven't time." How often do you say that? Just imagine the marvelous things you could do if you had the time to do them. Well, the fact is you *do* have the time. Plenty of it.

People marvel at all the things I do. How do I ever have the time to run about 30 companies, write editorials for 12 publications and also write a book in my spare time? Yet I seem to manage to get out and ski, scuba dive, cook a mean meal, and travel a bunch. Superman? Hardly. Ask any of my detractors.

Nah. I just try not to waste much time. If you keep at it it's incredible how much you can get done. You can do just about anything you want if you decide it's important. You can become an expert on digital electronics, on packet radio, on spread-spectrum, on security equipment and circuits . . . anything.

At work, do you amaze people with how much you get done? Or disappoint them with how little? As I write this I've just finished writing a couple editorials for my *Music Retailing* publication which goes to about 10,000 record stores . . . explaining about training and motivating clerks, avoiding employee theft, sponsoring some local performers and groups and how to gel more store traffic.

I also knocked off a report for the Economic Development Commission on the present position and future of trade unions . . . and another on a proposed *Educational Resources* publication which would list and review available educational satellite programs, videos and other such distant learning resources.

How can you get a bunch more done every day? That's easy . . . stop wasting so much time. There are so many addictive ways of wasting time . . . things we do without giving much thought. Take TV news, for instance. Total waste of your time. Ditto newspapers.

But, you protest, you have to know what's going on. Of course. I know what's going on, but I get my day-by-day information from one radio news broadcast via NPR in the morning. That tells me the top stories, but without my wasting a half hour watching TV.

If the news is of any importance it'll be in *Newsweek*. That eliminates the need to watch endless rehashing of blather on TV . . . and newspapers.

But gee, there are some good programs on TV. Sure, a few. Tape 'em so you can fast forward through the commercials and watch at your convenience. Be brutal—if it isn't interesting, dump it. This will get rid of all soaps, all talk shows . . . except Jay Leno's monologue . . . and most sitcoms.

Another rule: Avoid the telephone. Huge time waster. Few people know how to get their message across quickly. I prefer to write since it takes much less lime. No chit-chat. Well, not much anyway.

By combining your morning shower and shave you can get the whole works done in less than 10 minutes. And by having an office at home you can be at work in seconds. I do 90% of my work at home and keep in touch via fax.

Movies? When's the last time you saw a really good movie? Skip the junk.

There's an awful lot that needs to be done, so think over how much time you've been wasting and start using your time to make a difference in yourself . . . and then in the world.

Code For No-Coders

The sky has not fallen. Our bands have not turned into CB garbage, as predicted by thousands of old-timers . . . well, the bands aren't any worse than they were before the no-coders joined us. It's turning out that our new Techs are some of our better operators.

I'm still getting letters from no-coders complaining about the nasty welcome many have gotten when they tried going to club meetings. The message has been loud and clear . . . you're rotten people and we don't want to talk to you. Thanks heavens not all our clubs are like thaL Some have made a special effort to attract our newcomers and help them move up to higher licenses.

Almost every no-coder letter I've gotten has been enthusiastic about tackling the code and moving up to a General class license. Boy, am I surprised! Of course that's just what I said would happen . . . is Wayne right again? Some old-timers are really going to hate that.

Tackling The Code

The downside of all this is that there are still an enormous number of ignorant hams trying to teach the code. There doesn't seem to be any way to get through to some very numb skulls that learning slow and then gradually speeding up is one of the worst possible ways to learn the code. It's this prehistoric stupidity which has driven off hundreds of thousands of potential hams.

Please explain to anyone who still thinks that's the route to learn the code that we've known for over 30 years that the brain doesn't work that way. This is the way to frustration and madness. It's no wonder the worst mental cases in the hobby have all turned out to be Extra class hams.

Let's say that you want to get your General and Advanced class tickets. That means you want to be able to pass a code test at 13 per.

If you take the old ARRL route you'll first learn the dits and dahs for each character. Then you'll work your way up to five words per minute and pass your Novice and Tech exams. Then you gradually speed up . . . and two things happen.

When you go about it this way what you're doing, looking at it in computer terms, is setting up a look-up table in one side of your brain. Then, as you hear a character, you send the sound over to the other half of the brain to look it up and see what character it is. Then you send the answer back and write it down with the other side of the brain.

This works just fine up until you get to the clock speed of the brain. It won't translate any faster no matter how hard you try. This is the famous wall and it kicks in at around 10 wpm. This is where we've lost hundreds of thousands of potential hams . . . perhaps millions.

The only way past this wall is to go in an entirely different direction . . . and do what you should have done in the first place. The brain, in addition to being able to set up a look-up table, can also be trained to automatically translate for you.

If you've ever learned a foreign language you know how slow it is when you have to translate word by word, looking up the meaning in your memory. It's terribly slow and frustrating, both to talk and to listen. But once you start knowing what the words mean and think in the language, then it's easy. Well, it's the same with the code.

The system I recommend as the easiest way to learn the code is to have a tape (or a computer) and listen to it at the speed you want to be able to copy. Start right out at 13 per or even 20 per. You want to train your brain to automatically translate a certain sound pattern into characters for you. Four dits at 13 words per minute doesn't sound anything at all like four dits at five words per minute. So you turn on the tape and listen for an E . . . a single dit. Every time one goes by, write it down. After a couple of minutes the E's will jump right out at you. So start listening for I's. You'll notice that you start writing the I's, and that you're still writing the E's as they go by. You're on your way.

Many people who start out at 13 per are able to copy solid within a couple days. I've had many hams tell me at hamfests that they mastered 20 wpm in one single day! It's the changing of the sound patterns as you slowly speed up that makes learning the code by the old ARRL method such a bear. If I hadn't gone through all that torment myself I might have been more of a CW fan.

Just by a remarkable coincidence we happen to have the 13 and 20 wpm practice tapes available from Uncle Wayne's. I've made them fiendishly difficult to copy. No plain language. I've mixed letters, numbers and punctuation and made it as difficult as I could. I'll have you laughing as I hit you with one brain-breaker after another. When you get through you'll be good . . . darned good.

I don't provide any cheat sheets. The tapes are not to be used to test your speed. You don't need that. You know perfectly well whether you're copying solid or not. You don't need to check your copy. Copying code is supposed to be fun, not a strain. As soon as you try to push it, missing characters now and then, you're doing it wrong.

Plain copy makes lousy practice material. You want to be able to recognize Q and Z as easily as E and T, so you need the characters to be sent at random. Anyone who can copy my tape will almost fall asleep during a license test it'll be so easy. You need that extra margin to overcome the normal nervousness a test inspires.

Now get out there and fight the bastions of ignorance. Let's get all our new no-coders moving on up to Advanced or Extra. But let's not take a chance on generating another bunch of burnt out brains such as we hear braying on 14.313 or 14.275.

How's Your Code Speed?

While thousands of us are struggling for months to get our code speed up to 20 wpm so we can get that Extra class ticket, the world is on a completely different track. The world is not geared to 20 words per minute, it's handling megabits per second . . . gigabits . . . and now terabits.

Twenty words per minute is one hundred characters per minute. If we go with ASCII with 11 bits per character, that's 1100 bits per minute . . . about 18 bits per second. So here we are Morsing away at a top speed of 18 bits per second in a world whizzing by us at billions of bits per second.

It's not just big corporations teleconferencing via satellites, but more and more smaller companies, the police swapping data, pictures and fingerprints, and even kids in schools networking via satellites with kids in other countries. And they're not just writing notes to each other, they're sending newsletters with pictures and swapping full color camcorder videos.

Computer graphics have gone from black and white line work to full color high definition photographs and are now in full motion. The information bandwidth has been going up as we're cramming more and more digital data through the pipe. It's been going back down as we develop compression technology.

In the world of information exchange we're talking microwaves and satellite repeaters . . . the very frequencies we're using the least and are in the most danger of losing. So while we're sending messages of a few words . . . and screwing those up . . . passing these messages along our traffic nets . . . the world is moving into gigabits per second and sending digitized full-color high-definition video. That's right, some of our kids in schools are doing more communicating than one billion hams all sending simultaneously can do. We're the pony express trying to compete against faxes. We don't need more horses, we need to forget old man Morse and his oat-burner system and go electronic.

Sure, using what we now know about how the brain works, we can learn the code in a few hours . . . even at 20 wpm. But that's 18 lousy stinking bits per second. We've let a bunch of old men sell out our future by focusing us on the past.

The information age of today should be our world. It's a world of digital audio, digital video, multimedia, camcorders, VCRs, CD-ROMs, laser disks, desktop publishing, BBSs, networking, packet, CompuServe, Prodigy, satellites, fiber optics, cable, telephone wires, HDTV, pocket personal communicators, fax, and so on.

So what do I hear when I turn on my radio? "The rig here is an ICOM 735 with a two-element Bandmaster Quad antenna. Please give me your handle again, I missed it in the QRM."

It's almost enough to make a person think when you consider that there are more active users on CompuServe at one time than on all our ham bands combined. Do you think that it's possible we've lost sight of reality?

Now please don't think for a moment that I blame the ARRL for any lack of leadership in all this. That's as fruitless as blaming Congress and the administration for spending all that money and generating the $4 trillion deficit. Since when should we blame our leaders for our problems . . . and for a lack of leadership and foresight? No, we'll keep on electing crooks to Congress and old traffic handlers to ARRL directorships and we'll pay the consequences.

My wife has been enjoying far better QSOs via Prodigy with her little Macintosh Notebook (made in Japan, by the way) than I've been able to manage with my kilowatt and full-sized three-element beam . . . and at considerably less cost. When we travel she takes her Notebook with her and I take my HT. She plugs into the hotel telephone and is on line with thousands of people, while I'm kerchunking vacant repeaters one after the other, looking for someone to tell me what rig he's using.

Businesses are accepting these new technologies, as are more and more schools. Now let's see, where'd I put my rusty old hand key?

If you're interested in what our schools are doing with technology you might get *Smart Schools, Smart Kids*, by Ed Fiske (Simon & Schuster, 1991). Get ready for a nasty surprise. The generation of kids our old-timers has sneered at is running circles around us.

The Maturing Process

Old-timers mourn for the old days when we hams built our own equipment. Have we really gone soft, or is this just the natural order of things?

Well, with everything using ICs and transistors, we can't build the way we used to, right? Baloney! I doubt that really has much to do with it. I suspect it has more to do with the growth and maturation of new technologies.

When a new technology is starting there isn't any commercial equipment, so the pioneers have to build everything themselves out of whatever parts are available, be they tubes or ICs. Then, as interest grows, a few entrepreneurs start producing equipment. As soon as the equipment becomes available commercially that's the end of the pioneers.

In the 1920s we built our own receivers and transmitters. Then came the SW3 receiver from National Radio and almost immediately all receiver building stopped. By the time I came along in 1936 and visited every active ham in Brooklyn (NY), I was only able to find one who'd built his own receiver. Everyone else was using receivers built by Hallicrafters, National, Hammarlund, RCA, Browning Labs and so on.

We still had to build our own transmitters since there were none made commercially until after WWII. Yes, I know about the National 600, but that was so expensive I can't honestly count it. Lordy! It used Thordarson CHT transformers and cost around $10,000 in today's dollarettes . . . for a 600-watt AM rig.

I lucked into one in 1947 and used it for years on 75m. Then I used the power supplies and modulator for my 2m kilowatt rig on Mt. Monadnock. I put a solid signal into Norfolk, 600 miles away . . . even when the band was closed. There's nothing like 2,000 watts of audio on a 1,000 watt carrier on the highest mountain in Southern New Hampshire to punch through anything.

As soon as reasonably priced commercial rigs became available hams stopped building transmitters.

I've watched the same progression with RTTY, slow-scan, repeaters, VHF equipment, and then computers. Today very few hackers bother to build computers or even accessories, they just buy them and put their devious minds to software development.

It doesn't make sense to build anything which is available commercially. Manufacturers buy parts cheap, have all of the bugs out of the design (supposedly), and the unit has a resale value. If you build it you have a terrible time finding the parts, they cost ridiculously, debugging will drive you crazier, the unit has zero resale value and your friends will not respect you for having to make do with such a piece of junk.

How About New Technologies?

Yep, here's where experimenters come into play . . . or would, if we were developing any new technologies. The pioneers have to invent and build. Alas, pioneers tend to be youngsters and we've gone to a lot of trouble to keep them out of the hobby for the last 29 years. Outside of our new no-code immigrants, who've just started arriving, we have almost no youngsters.

Speaking of our no-coders, I'm not surprised at the arrogance they're meeting at many ham clubs. America has been welcoming immigrants this way ever since the second colony arrived 350 years ago and was snubbed by the first as lowly newcomers. We sneered at the Irish when they ran out of potatoes and came over. Shanty Irish. We sneered at the Italians. We made fun of the Dirty Litvaks (that's what we called 'em), and so on.

Of course after about three generations most of 'em became Americans and the melting pot worked. A few have kept fighting the system, calling themselves Irish-Americans, Italian-Americans, Polish-Americans, African-Americans. Hmmm, I wonder why we don't have Euro-Americans or Togo-Americans. Maybe the African-Americans don't know where their families came from, but it obviously must have been some place in Africa. Things will integrate a lot better when we have more people actually thinking of themselves as Americans.

Hmmm, Omar Sharif is from Egypt. Does that make him an Afro-American? Are white immigrants from South Africa also Afro-Americans?

Well, never mind . . . it was just a thought. I get off on tangents like that when things don't make sense. And freezing newcomers out of our ham clubs sure doesn't make sense. This fanatical worship of a mode of communications which is 50 years out of date continues to amaze me. Twenty words a minute in a 20,000 word a minute culture isn't rational.

Which would you rather read in *73*, about another antenna or digital audio and digital signal processing? Hey, we might have to actually try to think, so let's skip that digital crapola. Right?

Number 22 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Modifying your PK-232

No doubt about it, the AEA PK-232 has become one of the most popular multimode controllers In use by amateurs. But some people are trying various schemes to optimize its performance for AMTOR/Baudot operation.

I received a letter from Mike Lamb, the CEO of AEA, who addresses this problem. Mike says, "We have been hearing stories of hard-core AMTOR/Baudot users going through all sorts of gyrations hooking up CP-100, ST-6, etc., to their PK-232 hoping for the last dB of signal-to-noise performance. Some have even abandoned their PK-232 for some new 'high performance' AMTOR/RTTY-only controllers.

"I can only assume that the intent is to gain enhanced performance for low-speed Baudot and AMTOR. If that is the goal, I can save your readers some time, hassle, and perhaps even some money. It turns out that we have a relatively simple factory-approved modification that will optimize AMTOR and Baudot performance for the PK-232 by sacrificing 300 baud packet or ASCII.

"Whereas, we have not kept this modification secret, we obviously have not done a good job of spreading the word to hard-core AMTOR or Baudot users because of the reduced versatility.

"We have noted lately that there has been a renewed interest in high performance AMTOR and Baudot modem/controllers. For those users already possessing a PK-232, they can save themselves a great deal of expense by trying the subject modification first. R.F. Harris Engineers evaluated the PK-232 with the modification and found it to equal or exceed virtually any commercial sltor unit on the market.

"The modification consists of simply changing resistors R42, R52, R62, and R72 from 174kΩ 1% to 432kΩ 1%. Should any of your readers not have any 432kΩ 1% resistors, they can send a self-addressed, stamped envelope to AEA with a request for the 'AMTOR PK-232 Modification Kit' and we will return the envelope with parts at no charge, along with four each 174kΩ resistors, should they want to return the unit to its original condition."

We certainly appreciate the information, Mike. The resistors in question are located along the right side of the main circuit board, at the end of each group between integrated circuits U22, U24, U25, and U27, and comprise part of the digital filtering circuitry. If you make this modification, take your time, and use good printed circuit techniques. If you are not skilled in desoldering, DON'T! Ask someone else to put iron to board; you don't want to destroy a good controller by trying to improve it.

Once again, if you would like to receive the resistors needed to do, and undo, this modification, send an SASE to Advanced Electronic Applications, Inc., P.O. Box C2160, Building O & P, 2006 196th SW, Lynnwood, WA 98036. Ask for the "AMTOR PK-232 Modification Kit" as detailed in this month's "RTTY Loop" column in *73 Amateur Radio Today.*

"The Ameritron QSK-5 is an easy-to-install, external T/R switch for linear amplifiers, which adds full break-in operation to a high-powered amplifier."

Programs for the PK-232

While on the topic of the PK-232, John Boles KA6LWC, in San Jose, California, sent along some information via CompuServe. For users of the PK-232, there is a program that is almost a "buy and fly" called PHS300 (about 190K zipped). It is ONLY for the PK-232 and operates in the "Host" mode. There is some limited access to the command line, and it may have to be "fine tuned" to local repeaters or digital links. It handles all modes except NAVTEX, WEFAX or KISS. In the two years that John has been using the program, he does not relate any problems that were program related. It has been available on CompuServe HamNet, and I will try to add it to the collection of programs available from RTTY Loop.

Another program John mentions is ACUTERM, by Bill Kissel N8BA. It has some contest logging features but it too will only work with the PK-232.

It has colors and quite a few "bells and whistles." I'll see if I can find that one, too.

The Ameritron QSK-5

While we are discussing AMTOR and other such modes, MFJ, another of our digital buddies, sent along information on a new product they are touting, which is of particular interest to RTTYers.

The Ameritron QSK-5 is an easy-to-install, external T/R switch for linear amplifiers, which adds full break-in operation to a high-powered amplifier. Modes such as CW, packet, or AMTOR, which require high-speed T/R switching, can now be run with an existing linear amplifier. This totally silent device, which is six times faster than mechanical vacuum relays, can be moved to new equipment as need dictates.

It is silent, electronic PIN diode switching which accounts for the fast operation and sure switch handshaking of the QSK-5. This eliminates hot switching of the amplifier, and minimizes TVI, RFI, and key clicks. There is also an exclusive "Amp Saver" feature that completely turns off your amplifier's plate current between dots, dashes, and words. Your amplifier lasts longer, runs cooler, and works full break-in while running quietly, far surpassing the abilities of mechanical vacuum relay switches.

Electronic PIN diode switching may well be the solution as interdigitated modes require more complex and reactive switching arrangements. The QSK-5, which is installed without internal wiring by plugging in a few cables, addresses this need directly. The unit handles 2500 watts PEP, and 2000 watts in normal amateur service, with an SWR below 1.5:1. In continuous modes, like RTTY, SSTV, or FM, power is limited to 750 watts. An optional cooling fan will allow sustained operation at 1500 watts in any mode.

For more information, contact Ameritron at 921 Louisville Road, Starkville MS 39759; toll-free telephone (800) 647-1800.

Interest in the various software packages discussed here in the past few months remains at an all-time high. Once again, if you would like to receive copies of the software discussed, for IBM PC compatibles, send a self-addressed, stamped disk mailer, $2 in US funds, and a disk, either 5" or 3", to me at the above address. High-density disk users (1.2M or 1.4M) have been known to receive extra goodies to fill up those vacant bytes, so there is an advantage to using high density disks if you can.

John Boles, who helped us out with software finds above, also points out that with regard to the Baycom modems, Craig Rader N4PLK has kits available, with schematics, for the Baycom modem. Kits are $45 + $2.50 s/h U.S., $5 outside the U.S.; fully assembled units are $55 + $2.50 s/h U.S., $5 outside the U.S. Of course one should write Craig for the latest prices, at 385 Cherokee Court, Altamonte Springs FL 32701.

Similarly, I have found quite a few of you interested in America Online. Users of IBM PC compatibles need a mouse, EGA, VGA, or Hercules graphics, and a hard drive to access the system. Terminal programs are available for PCs, Macintosh systems, and Apple II computers. If you are unable to contact them yourself, I will be happy to have a starter package sent to you directly. Just send me your name, address, and telephone number, computer type, and, in the case of PC compatibles or Apple II, disk size (5" or 3").

In the meantime, I look forward to more goodies next month. Spring is in the air here in Baltimore, and while baseball season is the big local news, there's plenty to do in the hamshack as well. Let me know what you're doing via mail, on CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR), or America Online (screen name MarcWA3AJR).

Number 23 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

QCWA as a Resource

Most thoughtful adults in the world today would agree that children are our most important natural resource. We who are involved in education are constantly looking for new ways to stimulate and hold the interest of youngsters in our classrooms. One of the best methods for motivating a group of young people is to have a lively demonstration or presentation by an enthusiastic guest speaker. No matter how expert and excellent the primary teacher or instructor may be, there's nothing so refreshing as a change of pace with a different speaker in front of the room. Besides bringing in a new face and a different personality, the guest you invite can provide a different expertise and a new way of looking at things. If properly planned, your guest speaker can give your class or group just the extra little excitement and motivation they may need.

During the last 12 years of teaching 6th, 7th, and 8th graders, I've discovered that one of the best resource pools of talented, dedicated, and gracious amateur radio operators is the Quarter Century Wireless Association (QCWA). I count many of its members as my friends today. Whenever a call for help in the classroom was put out, assistance was always forthcoming from this group. Their membership has within its ranks all the history and enrichment of radio. They are the guardians of all that went on before, yet they look to the future in order to perpetuate that which is best about amateur radio.

QCWA has established and funded, through the generosity of its members, a program of scholarships awarded to young men and women in amateur radio who are working toward their formal educations. The program honors QCWA Silent Key members, in whose name the scholarships are issued.

Carl Felt Jr.

One of the most generous and talented individuals I've met through this organization is Carl Felt Jr. N2XJ. Whenever I meet Carl at the Hudson Division Cabinet meetings, he's always got some new idea or project to suggest for the betterment of amateur radio. I'd like to honor Carl by sharing some of his unique background in this column.

Photo A. Carl N2XJ and Carole WB2MGP, both assistant directors, at a Hudson Division Cabinet meeting.

Carl Felt Jr. was born on December 18, 1908, in Peking, China, the son of Methodist missionary parents. All his pre-college schooling was at the Peking American School, with the exception of his furlough years. One of the most fun things Carl remembers from those early years was in 1921 when radio broadcasting was just starting and his aunt gave him a crystal radio set kit for Christmas. He remembers that KDKA, WGY, etc. were on the air, somewhere around 360 meters. There was also a station on Bedloe's Island operated by the Army on a much longer wavelength.

Carl's family was in this country for a while, and his father kept encouraging his interest in radio. When they returned to China in 1922, Carl had a full set of honeycomb coils and a detector and one-step amp. He and a friend learned the code from a *Boy Scout Handbook* and set up battery-operated Ford spark coil stations. They could talk across town in Peking. Carl's call was XJ, self-assigned and without benefit of any authorities. They practiced the code by listening to commercial stations, especially the ships plying up and down the China coast. Carl remembers his dad's surprise when he showed him some messages in German (which he didn't know) that he'd copied. Then he believed that his son was really doing something in his attic shack!

In addition, the honeycomb coils enabled him to listen to the longwave arc stations . . . NPO in Cavite; NPG, NPM in the Philippines, Guam, and Mare Island, California, respectively. Carl regrets to this day that he was not in China when worldwide DX came to the ham bands!

Back in the U.S., Carl graduated from Cornell College where he met his wife of 61 years. During the Depression in New York City, he felt he was lucky to get a job at $25 a week with the *Daily News* in its advertising department. It led to a 43-year career in advertising . . . except for a four-year hiatus for WWII. Despite having a wife and three young girls, Carl got patriotic and applied for a commission in the Navy. He thought he could be a communications officer since he'd been licensed since 1928 as W9FJA while in college. But the Navy was more interested in his foreign background and ability to speak Chinese, so he wound up in the Naval School at Columbia University. There he had nine months of intensive study preparing to be a military government civil affairs officer. The successful completion of the course netted him an M.A. degree in political science.

Carl's service as a Naval officer was very varied and gave him the opportunity to also serve with the Army and Marine Corps. After a period of sea duty in the Atlantic on a destroyer escort, he was assigned to the Office of the Chief of Naval Operations; after that to Pearl Harbor, and then transferred to the 10th Army. Carl heard rumors that the 1st Marine Division was going back to North China. He jeeped up to 1st Mardiv headquarters, applied for a job, and was transferred just in time to leave for a return to his old home!

The U.S. mission in North China was to accept the surrender of the Imperial Japanese forces without taking sides between the Nationalists and the Communists. The Division did discharge its many tasks, one of which was to assist in the repatriation of Japanese military and civilian personnel from North China to Japan. Carl was made repatriation officer of the 1st Marine Division, based in Tientsin, and given the responsibility of organizing and directing the repatriation of the Japanese. At the peak of the operation, the division was shipping out 6,000 Japanese per day. During the time Carl ran the Division, he saw more than 500,000 Japanese returned to the island from which they had come.

When Carl came back home again, he spent his time catching up with family matters and his business career. He remained in the Naval Reserve and retired with the rank of captain in 1968 when he was 60 years old! He also returned to amateur radio. Carl recalls that much had changed. Even Chatham, New Jersey, which had been in the 3rd call area when the WWII shutdown came, was now in W2-land. When the "N" calls came and Carl got his Extra class ticket, he got his old XJ call back with an "N" in front of it.

Carl believes he would never have volunteered for the Navy if he hadn't have been an amateur radio operator. He hadn't been especially interested in boating or the ocean, but he did think he would have made a good communications officer. To this day, Carl feels that he has amateur radio to thank for a second career which has given him great experience in the service of his country. It's also proven itself to be a hobby that he's always enjoyed and will continue to enjoy as long as he lives.

Just think about the enrichment that radio operators of Carl Felt's caliber can provide to a group of youngsters. Consider inviting them to your classes and club meetings! ■

Number 24 on your Feedback card

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DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '92 issue must be in our hands by February 1st. Mail to 73 Amateur Radio Today, 70 Rte. 202 N, Peterborough, NH 03458.

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Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

Deadline for the July classifieds is May 18, 1992.

ging, driving, or dancing. Order "**RHYTHM OF THE CODE**" cassette single hit today! Send $5.95 (plus $2 S&H) to "Kawa Productions," P.O. Box 319, Dept. St., Weymouth MA 02188. For Information send SASE. BNB899

AMATEUR RADIO REPAIR!! All makes & models, any age. $20.00 per hour-maximum labor per unit, $80.00. TELO (Dan), 302 S. Uplands Dr., Camano Island WA 98292. (206) 387-3558. BNB900

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COMMUNICATIONS AT ITS BEST! AR-900/950 $245.00, AR-1000XC $399.00, AR-2500 $469.00, AR-3000 $969.00, Extended Warranties. CB's, Scanners, Radar Detectors, and more. Free Shipping Visa/MC/Diners. Turbo Electronics, P.O. Box 8034, Hicksville NY 11802. inquiries: 516-938-1946/orders (800) 33-TURBO. BNB905

BATTERY PACK REBUILDING: SEND YOUR PACK / FAST SERVICE. ICOM: BP2/BP3/BP22 $18.95, BP5/BP8/BP23 $24.95. BP24/BP70 $26.95, BP7 $29.95. KENWOOD PB21 $14.95, PB21H/PB6 $19.95, PB25/26 $22.95, PB2/KNB3 $29.95. YAESU: FNB10/17 $22.95, FNB3/4/4A $34.95. UNIDEN APX650 $29.95, APX1200 $39.95; HEATH110 $26.95. "NEW PACKS": ICOM BP8(800 mAh) $39.95, (1000) $49.95, (1200) $54.95, BP83 $29.95, BP84 $42.95. YAESU: FNB2(500) $19.95, (600) $23.95, FNB10S (1000) $42.95, FNB12S(600) $46.95, FNB17(600) $31.95, FNB4SL(750) $44.95. SANTEC: 142/1200 $22.95. "U-DO-IT INSERTS" ICOM: BP3/BP22 $14.95, BP5 $20.95, BP8 $19.95. KENWOOD: PB21H/24 $14.95, PB25/26 $17.95. TEMPO/S $20.95. YAESU: FNB10 $14.95, FNB4/4A $26.95. AZDEN/300 $14.95. FREE CATALOG. $4.00 Shipping/order, PA+6%, VISA-M/C +$3.00, CUNARD, R.D. 6 BOX 104, Bedford PA 15522. (814) 623-7000. BNB913

WANTED: BUY & SELL All types of Electron Tubes. Call toll free 1 (800) 421-9397 or 1 (612) 429-9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB915

COMMODORE 64 HAM PROGRAMS-8 disk sides over 200 Ham programs $16.95./$.29 stamp gets unusual software catalog of Utilities, Games, Adult and British Disks. Home-Spun Software, Box 1064-BB, Estero FL 33928 BNB917

AZDEN SERVICE by former factory technician. Southern Technologies Amateur Radio, Inc., 10715 SW 190 SL #9, Miami FL 33157. (305) 238-3327. BNB979

COMMODORE 64 REPAIR Fast turn around. Southern Technologies Amateur Radio, 10715 SW 190th Street #9, Miami FL 33157. (305) 238-3327. BNB982

FOR SALE: Seven 450 MHZ BP/BR filters, $350, K. Spies, P.O.B. 48185, Niles, IL 60648-0185 BNB983

"WANTED: RECEIVER NATIONAL HRO/60 with operating manual and coil set A to J." Giorgio, P.O. Box 144, Howard Beach NY 11414. Phone (212) 685-3947. BNB984

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MIAMI SCANNER ACTION IS HOT, Hear the cops and more. One call does it all. (305) 460-3374. BNB986

WANTED: Waters Coax TVI Filler #373-6; Six meters. WA0KKC, 7139 Hardy, Overland Park, KS 66204. BNB987

HOBBY/BROADCASTING/HAM/CD/SURVEILLANCE transmitters, amplifiers, cable TV, science, bugs, other great projects! For catalog, call/write (916) 534-0417. PANAXIS, Box 130-S9, Paradise CA 95967. BNB991

HEAVY DUTY REPAIR TIPS MANUALS. Stereos-cassette $5, TVs $20, VCRs $25. All 3 $40. Berge Systems, Unit 342-ST, 253 College, Toronto, Ontario, Canada, M5T 1R5. BNB992

AMATEUR RADIO REPAIR: FCC licensed, 17 years experience, lab quality NBS traceable test equipment, reasonable rates, G.B. Communications, Inc., 963 Birch Bay, Lynden Road, Lynden WA 98264. (206) 354-5884. BNB993

VIDEOCIPHER/SATELLITE/SCANNER/CABLE/AMATEUR/CELLULAR. Repair Manuals, Modification Books & Software. Catalog-$3.00. **TELECODE** P.O. Box 6426-RF, Yuma AZ 85366-6426. BNB994

QRP COMPONENTS Catalog, large SASE. KA7QJY Components, 944 N. 700 East #1, Logan UT 84321. BNB995

ROTOR PARTS ROTOR service, ROTOR accessories: Brak-D-Lays, Quik-Connects, Pre-Set mods. NEW models for sale. Free catalog. C.A.T.S., 7368 SR 105, Pemberville OH 43450. BNB996

SURPLUS. HUGE QUANTITIES. LOWEST PRICES in America! Dealers wanted. Catalogs, $3. Surplus Traders, Box 276A, Alburg VT 05440. BNB997

FOR SALE: Clegg Mark 3 2m FM, working but NMR $75, Klaus Spies POB 48185, Niles IL 60648-0185. BNB998

Number 26 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

FCC Enforcement

For years, the FCC has maintained that there is very little money and staff available to enforce the rules on the ham bands. With limited resources, the FCC must set certain priorities, beginning with matters of public safety. Of course, the FCC's first enforcement priority is, and should be, investigating interference effecting law enforcement, public safety, aviation and other life, death or property services.

If you've read this column more than once, you know that I feel amateurs should be self-policing. Since the FCC doesn't like to be bothered by the petty problems of amateur radio (and most of them *are* petty), it only drives another nail into amateur radio's coffin, every time one of us bugs the FCC with a minor infraction, pet peeve or other time wasting complaint. Unless it's positive PR, the less attention we draw toward ourselves the better.

While we amateurs should work to settle our own differences, this does not mean that the FCC can or should wash their hands of the entire Amateur Radio Service. We have some serious enforcement problems—some that have been going on for years—and it is high time the FCC stopped hiding behind the "no money or manpower" excuse and started cleaning up some of these problems.

If the FCC is so poor and understaffed, why is it that they can spend hundreds of thousands of dollars chasing down a bunch of kids broadcasting rock music on the relatively barren frequencies above the 40m band, when we've got hoards of violations happening on the heavily populated 80, 20, 10 and 2 meter bands? I submit that it is not a question of money and personnel, it is a matter of management and priorities—both bad.

I am sick and tired of losing the use of 50 kHz of the 20m band to various forms of vermin, while the FCC spends thousands to chase down harmless "pirates" on 7.415 MHz. I have heard blatant violations of several FCC regulations on an almost daily basis on and around 14.313 for over five years, and with the exception of a few fines, the FCC has done absolutely nothing to solve the problem. It is obvious that this group of idiots is not going to go away on their own. As a taxpayer, I am furious that the agency empowered to clean up this mess puts busting linear-using CBers (because of a handful of complaints) above the continued clogging of a major portion of an international resource. A few hours spent monitoring on a Saturday afternoon would provide ample evidence to revoke the licenses of dozens of these operators.

I am tired of listening to barely disguised commercials for various publications and organizations. I am sick to death of listening to hour after hour of intentional interference, all for the sake of a few contest points. I am at the end of my rope when it comes to amateurs who don't understand that you can't fit 10 kHz of audio into a 3 kHz wide signal.

I'm not the only one who feels this way. Judging from my mail, not to mention the hundreds of hams I spoke with at the Dayton Hamvention (and the hundreds of others at hamfests across the country), the general feeling among ham radio operators is that the FCC is using the "self-policing" excuse to shirk part of their enforcement responsibilities. It's hard for your average amateur to accept the thousands of dollars put into chasing down a couple of teen-agers with a 40 watt AM transmitter connected to a tape deck, when we are forced to put up with blatant and repeated violations by known persons or organizations occurring from one end of the amateur spectrum to the other.

As the editor of the Arlington (VA) 10 - 10 News put it in a recent newsletter, ". . . something is very wrong when a Federal regulatory agency expends its resources chasing minnows, while the sharks swim free."

There are two reasons why this lack of attention to ongoing violations really ticks me off. First, I just did my taxes. When I figure the percentage of my income that goes to Washington every year and then figure the value I'm getting for my investment, it makes me want to scream. The fact that I am an Amateur Radio Operator has very little to do with it. I am a taxpayer, paying for the operation of the FCC, and don't like the way they are setting enforcement priorities. Second, as an Amateur Radio Operator and proud citizen of the United States, I feel that rules violations that occur on bands where propagation insures that the violations are being heard all over the world should be given more priority than a CBer getting into his neighbor's $20 telephone.

I am not advocating that thousands of you start writing to the FCC, demanding action on whatever has got your goat this week. This will make us no friends in Washington and only serves to clog up the works (since every complaint, no matter how real or imagined, must be answered). What I am saying is that you, I and the FCC are well aware of several ongoing violations of Part 97. It's about time the FCC did something to clean up these messes.

The time for reading about these fools in the amateur radio press (and we all know who I'm talking about) is over. The time for passing out fines is over. Certain problems have gone way beyond the realm of "self-policing." Now is the time for the FCC to clean house a little, and they can start with the cesspool on twenty meters. Now is the time for certain hams to lose their licenses, and for several to spend some time in jail.

When they're through rounding up the hooligans on 20 meters, how about it if the FCC spends a few contest weekends tracking down the illegal power operators and intentional interferers. If they did this over the course of six or eight major contests, maybe contests would once again become a fun way to sharpen operating skills instead of the display of "who can buy the biggest signal" they have become.

After that, the FCC could spend a couple of days listening to that repeater out in LA (you know the one I'm talking about—it was in all the papers). It wouldn't take much monitoring to get the evidence necessary to revoke the trustee's license and shut down that embarrassment.

While they're at it, why don't a couple of monitoring stations put on a pot of coffee and spend a few late nights listening to the filth that has become the 80 meter band (if you think this contradicts what I've written about the First Amendment, go back and read it again)?

The concept of a "self-policing" service, which is a nice thought, is and always has been a myth. You cannot enforce regulations without the legal authority to back up that enforcement with punishment. It's time for the FCC to give up the convenient lie of amateur radio being self-policing and to start giving the amateur radio taxpayers their fair share of protection from illegal operators.

The FCC has the authority. I hope they start to wake up to their responsibility. 73

Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

HF propagation conditions for June 1992 are liable to be the worst in a long time! The reason for such a gloomy prediction is the seasonal "HF Doldrums" one can expect in June, plus the decline of the sunspot cycle, and some forecast periods of extremely unsettled conditions related to the earth's magnetic field. All of these, of course, relate to the sun itself . . . some directly and some indirectly.

The days of June 6th, 10th and 16th are likely to be the focus of some extreme ionospheric upsets on, or a day or two before or after, these dates; which is the closest I can come at the time of this writing in March. For hams who are interested in relationships between the sun and other geophysical events, look for possible earthquakes, volcanic eruptions and violent atmospheric storms around these dates, and particularly VLF or ULF "signals" and perturbations of same.

The chart shows which days are likely to be the worst (P), those which might be acceptable (F), and those which might be good (G). Daytime best bands will be 17 and 20, with much short skip and some DX. Bands between 30 and 160 will be virtually useless during the daytime. At night, you can count on 20 meters to be open for DX some evenings, and the bands between 30 and 160 open variably, depending on atmospheric "noise," i.e. QRN.

There will be a partial eclipse of the moon on June 15th, visible from Antarctica, North (except extreme NW) America, Central and South America, as well as East Africa, Eastern New Zealand, and the southern tip of Greenland. On June 30th there will be a total eclipse of the sun with totality observable only from West Africa and Central America. The summer solstice and longest day will occur on June 21st, and a full moon on June 14th.

I hope these gloomy predictions for June propagation DON'T come true, but let's wait and see. It could be a very GOOD month for VHFers who will find some conditions much to their liking. Always listen to WWV at 18 minutes past any hour for current updates on solar-geophysical data and announcements of importance. See you next month. W1XU. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	—	20	—	—	—	—	—
ARGENTINA	20	20	20	40D	40D	—	—	—	—	—	10	15
AUSTRALIA	—	—	—	20	20	40D	20D	20D	—	—	—	—
CANAL ZONE	15	20	20	—	—	—	20	20	20	—	10D	15
ENGLAND	20	—	40/80	40/80	—	—	—	—	—	20	20	20
HAWAII	15D	20	20	20	40D	40D	—	—	—	—	—	15D
INDIA	20D	20D	—	—	—	—	—	—	—	—	—	—
JAPAN	—	—	—	—	—	—	20	—	—	—	—	—
MEXICO	15	20	20	—	—	—	20	20	20	—	10D	15
PHILIPPINES	—	—	—	—	—	—	20D	—	—	—	—	—
PUERTO RICO	15	20	20	—	—	—	20	20	20	—	10D	15
SOUTH AFRICA	—	40	40	20D	20D	—	—	—	—	—	20D	20D
U.S.S.R.	20	20/40	20/40	—	—	—	—	—	—	—	20	20
WEST COAST	40	80	—	—	—	—	—	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	20D	—	—	40D	—	20	—	—	—	—
ARGENTINA	20/40	20/40	20	40D	—	—	—	15	15	15	15/20	20
AUSTRALIA	15D	15D	15/20	20	20	40D	20	20	—	—	15D	15D
CANAL ZONE	20	20	20	40D	40D	—	20	20	15/20	15	10D	10D
ENGLAND	20	—	40D	40D	—	—	20D	20D	—	—	20	20
HAWAII	15	15	20	20	20	40D	20	20	—	—	—	15D
INDIA	20D	20D	—	—	—	—	20D	20D	—	—	—	—
JAPAN	—	—	20D	—	—	40D	—	20	—	—	—	—
MEXICO	20	20	20	40D	40D	—	20	20	15/20	15	10D	10D
PHILIPPINES	—	—	—	—	—	—	20D	20D	—	—	—	—
PUERTO RICO	20	20	20	—	—	—	20	20	15/20	15	10D	10D
SOUTH AFRICA	—	—	40D	20D	20D	—	—	—	—	—	—	—
U.S.S.R.	—	—	—	—	—	—	20D	20D	—	—	—	—

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	20	20	20D	40D	20D	20D	—	—	—
ARGENTINA	15	20D	20	20	—	—	—	20D	—	—	—	15
AUSTRALIA	15	15	15	20	20	20/40	40	20/40	—	—	—	—
CANAL ZONE	10D	15	20	20	40D	40D	—	20	20	—	15	10D
ENGLAND	20	20	20D	—	—	—	—	20D	—	—	—	20D
HAWAII	15	15	15/20	20	20	20/40	40/80	—	20	—	15D	15
INDIA	—	—	20D	20D	—	—	—	20D	20D	—	—	—
JAPAN	—	—	—	20	20	20D	40D	20D	20D	—	—	—
MEXICO	10D	15	20	20	40D	40D	—	20	20	—	15	10D
PHILIPPINES	—	—	—	20D	20D	—	—	20D	20D	—	—	—
PUERTO RICO	10D	15	20	20	40D	40D	—	20	20	—	15	10D
SOUTH AFRICA	—	—	—	20D	20D	—	—	—	—	—	—	—
U.S.S.R.	20D	20D	20D	—	—	—	—	20D	—	—	—	—
EAST COAST	40	80	—	—	—	—	—	20	20	20	15	40

Note that a (D) will indicate a difficult path. Try on days when the geomagnetic field is quiet (G) and when solar flux is 100 and greater

JUNE 1992

SUN	MON	TUE	WED	THU	FRI	SAT
	1 P	2 P	3 P–F	4 F	5 F–P	6 P
7 P–F	8 F	9 F–P	10 P	11 P	12 P–F	13 F
14 F	15 F–P	16 P	17 P	18 P	19 P–F	20 F
21 F–P	22 F	23 F	24 F–P	25 P–F	26 F	27 F
28 F–P	29 F	30 F–G				

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LETTERS

Number 1 on your Feedback card

From the Hamshack

Arthur C. Erdman W8VWX, Worthington OH Part of your editorial in the January 1992 issue contained, for the first time in print, praise for the work done by myself and my shipmates. I was one of the instructors in receivers In Radio Material School (USNR-Special Assignment) who "fiendishly" put in bad components to be found by the students. I taught at Navy Pier, Chicago, from 1945 to 1946. At college, they looked down their noses at my experience in Navy electronics.

You hit the nail on the head by saying much of college was not interesting nor to the point. Only in my fifth year did I get anything really interesting. It was the detailed study of TV receivers.

I've retired from electronics and now am helping my oldest son in his financial business (CPA). With three computer systems, he can do much more work in a shorter time period. Ham radio is not the only group with old fogies—some CPAs absolutely refuse to learn how to operate the computer systems. They are being left behind.

Keep blasting hams to "shape up—ship out."

Joseph P. Esposito N2NSO, Bronx NY I really enjoy reading *73 Magazine*. I look forward to the next issue each month. I am responding to WA5BMN's comments *["Letters," January 1992]* about contesting on the amateur bands, especially 10 meters.

I am a Tech and my phone privileges, as you know, are a small spectrum of the amateur bands. I am a radio warrior on the weekends and look forward to working DX. But when I get home on Friday night from work, fire up the radio, and I hear "CQ contest," I shut down and I work my 2 meter radio.

I have to agree with WA5BMN: I do like using my radio equipment on the weekends; HF, that is.

Bill Strickland KC4CUM, Huntsville AL I have been reading your magazine for several years and think it is by far the best that I have ever seen. Your ideas and proposals about radio, morals, and enthusiasm are always refreshing and uplifting.

It was only recently that I discovered that you were a member of the silent service and on the *USS Drum*. I have fond memories of a favorite uncle Roy B. Hester who was on several of the old pig boats and later made 13 patrols on the USS Nautilus as Chief Electrician's Mate, including the Battle of the Coral Sea and Midway.

Thanks for the influence you continue to have on your readers.

Dick Melcher WA6MDI You talk about the 14.313 mess. Well, I ran into the same kind of thing when I moved into the Rogue Valley 18 months ago. I was interested in having a 440 MHz input and a 2m output remote base. Some of the local "powers" got wind of this and started bad-mouthing me. At the local radio club I was asked, "Who do you think you are, coming up here from California and doing this in *our* valley?" Seems that a group feels that 2m is for rag-chewing and that packet, repeaters and, most of all, autopatchers, have no use on *their* band. So I put up a 440 MHz repeater to control an ICOM 735 with an Ultra-Com Shack 64 and an AT-150 auto antenna tuner. I've already got a half dozen users, including a blind man and some users in retirement manors where outside antennas are not allowed.

Anyone else doing this? This is a great service for hams in poor locations and I'd like to see more like this. Dick, if we lose amateur radio, it'll be your grousing retrograde neighbor hams who have killed the hobby, not you . . . Wayne

Garry Neill K4FRL, Acworth GA I met you about 20 or 25 years ago in the hospitality room at the Atlanta Radio Club Hamfest. I knew that you were a "maverick" from what I had been told. But, I found that I liked what you said. I have since agreed with your philosophy and your ideals. Please, keep prodding me (hams) and the other groups that you are working with.

I haven't followed your exhortations to the extent that I should, but I enjoy your continuing to encourage me on to greater accomplishments. You have my backing for any idea or project that you have. I can say that, based on my reading your writings for the past 20+ years, you have been "right on target." Keep up the good work.

Jim Travis AC4JI, Nashville TN Agreeable or disagreeable, your editorials are provocative, more often on target than off. Practical or not, you generate volumes of ideas. Ideas are the lifeblood of creativity. What makes you uncommon is that you act on your ideas and often succeed. When others act on your ideas, good things can happen.

For more than 20 years my ham license, WB4HNS, was rarely used. In the mid-'60s some excellent Army instructors at Fort Dix, NJ, taught me code. These guys could strap on a leg key and bat code back and forth and never take a note. It was made clear that if you didn't learn, you would be backpacking in the snow on the other side of the post—the Army's answer to incentive licensing, I guess.

Near the end of Army service, two sergeants at Ft. Polk, one an ex-Western Union telegrapher, introduced me to ham radio at the MARS station to which I'd just been assigned. They administered the Novice exam. Picture yourself as a Novice sitting before a Collins S-line console, courtesy of Uncle Sam, with beams, an inverted-V, a long dipole, most of the operating time you could want, and a couple of fine operators right there to learn from. Few Novices are ever so lucky.

After Army service I upgraded to General class, used a 75 watt crystal CW rig for awhile, then all but quit the hobby. Excuses: apartments and a condo with no antenna space, career demands, family expenses, no decent equipment, never hearing much on 2 meters for which I DID have gear.

The license would be renewed, ham magazines read, a few projects built. I would call on 2 meter FM but get little out of it. Computers became a serious hobby.

The old Eico CW rig gathered attic dust beside a Heath SB-300 receiver, its crystals removed and employed in a home-brew shortwave converter for the car.

A few years ago I began paying attention to your jarring editorials. Your message to me was and still is: Got a license? Use it or lose it. Same goes for valuable chunks of radio spectrum.

One day colleagues at work invited me under their 1990 Field Day tent. That day the fire was lit and refused to go out. Soon I found an affordable used HF rig, some Hustler coils and a modem 2m HT, figuring if I can't put up an antenna where I live, I'll go mobile.

One hundred ten countries, 50 states, a thousand QSOs and two quick upgrades later I am still mobile. In front of me are two prized original cards that arrived today from mobile contacts with Jordan and Antarctica. Am I enjoying the heck out of this? You bet.

Last year I signed on with Army MARS, the local radio club, and QCWA—met some great people, contribute as work permits, proselytize a lot about ham radio but itch for more. Satellites and the upper spectrum have yet to be explored. If there is a way to work those mobile, believe me I will find it.

This hobby is, as Robert Louis Stevenson put it, "so full of things we should all be happy as Kings." There is no end to the challenges, no limit on our frontier.

Had you not been such a nag all these years, Wayne, I would not be writing to thank you.

There are, in fact, many to thank, beginning with the two sergeants whose names and calls I wish I could track down. They must now be close to retirement.

Above all, I will remember a young 11-year-old worked in a contest over a year ago. In a few short months he had gone from no license to Advanced. With his father's obviously able help he was preparing to march on Extra. If HE could do it, so could a 49-year-old. A few months later I walked out of a VE session as /AE awaiting a new call.

Our hobby faces serious problems and challenges. Perhaps the new people enticed by no-code licensing will show the way. We need the new blood. Most no-coders I run across will be credits to the hobby. Most already are at work on upgrades, some with remarkable dedication.

What is nice to know as I meet people on the bands is that this rejuvenated interest is NOT unique. Many have followed similar paths. Invariably we regret the time away from ham radio. We are glad to be back.

I hope more of us read and re-read David Cassidy's February 1992 piece on how to generate a QSO conversation. It is important. As a journalist, an interviewer who enjoys extended QSOs with the interesting people of our hobby, be assured the techniques work. David's article could be Lesson 2 in any operating manual, Lesson 1 being how to tune up quietly.

The points he makes were driven home for the first time by a ham visiting here from Kentucky, a minister, active on 2 meters. This gentleman never really said much in his QSOs on a local repeater. He didn't have to. He asked questions, made observations. He drew people out. Many interesting experiences and a few life stories were told in those QSOs. He was absolutely the best and brought out the best in his contacts.

Keep those editorials, line columns and concise construction articles coming. Most of all, thank you for your prodding. Don't ever let up.

John Seginski N7NV, Reno NV Wayne, first of all, I think you're crazy. Or mighty eccentric to say the least. And that is no insult, believe me. I've been reading your editorials since way back when you first started *73 Magazine*.

I'm glad you're crazy. That's why you've accomplished so much in your life. I don't think "normal" humdrum people accomplish anything, especially in the technical fields.

The reason I'm writing is because I think you're too hard on some of the old modes of operating, like CW and AM. I've recently got back on 10 meter AM (popular AM window, 29.0 to 29.2 MHz) using a Johnson Ranger and a Collins 75A4 and have been having a really good time. I can call CQ and meet a lot of new friends, and we talk for hours about the technical aspects of the old rigs. Sort of reminds me of the fellows I know at the classic car club when they get together to discuss the pros and cons of whether a straight 6 engine is any better than a V8, or vice versa, in their old cars. In the classic car club we never talk against the guys who own and drive the old cars.

And I'll bet when you were in your Porsche club you didn't talk against the fellows who owned and drove the old Speedsters, did you? You probably talked with them about the characteristics of their old cars even though they weren't state of the art. Why can't you afford the same courtesy to the hams who enjoy the old modes of communication? Remember: Ham radio is supposed to be fun, regardless of what mode is being used.

You won't find many hello/good-bye QSOs on 10 meter AM phone. Some of the guys (old and young) can literally talk your ears off. They don't use VOX and when they are talking, they have the podium.

Take a listen. I think you'll be pleasantly surprised, and get yourself that old boat anchor rig you dreamed about when you were young, but couldn't afford, and get on the air. I'd like QSOing with you.

Using old classic modes like CW and AM does not detract from the modern modes of operation. I still love SSB, packet, FM, TV, etc., but I do stay off VHF and UHF because every time I get on, all I hear is people clicking their HT transmit buttons and invariably someone will come on and say, "Could you stop transmitting? You're tying up the frequency." That's not the type of ham radio operation I care for.

And CW. If you run high power, I agree it could be detrimental to your health. But you really don't need much power when the band you're using is open. There's nothing more relaxing than clicking away on the old Vibroplex on Saturday mornings on good old 40 CW.

We should all enjoy all the great aspects of ham radio. All modes and all bands. They all have their advantages and disadvantages, and they are all fun.

So lighten up Wayne. Have fun, and I hope to see you on good old 10 meter AM.

THE TEAM

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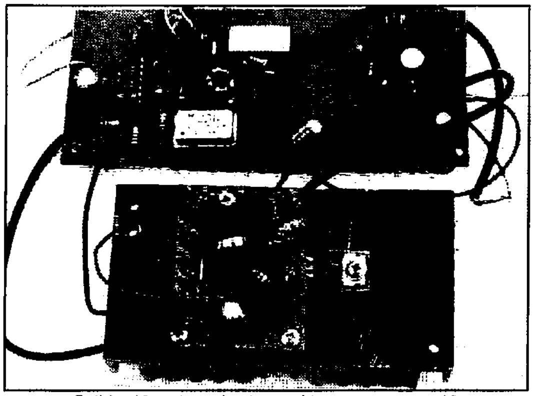
TABLE OF CONTENTS



Build a 10 meter voice transmitter . . . see page 18.

FEATURES

REVIEWS

Cover: QRP and camping . . . a great summertime combination! See our review of MFJ's new QRP rig on page 36. Cover photo by David Cassidy N1GPH.

DEPARTMENTS

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NEVER SAY DIE

Wayne Green W2NSD/1

Flea Markets

The great cry from builders has to do with finding parts. You can't build much if you have to rely on Radio Shack for all your parts. And you're limited if you have to depend entirely on equipment that's available in parts kits. So how can you find the parts you want? Well, they're all there by the zillions in the larger flea markets. The only problems are (a) getting to a big enough flea market to find what you need, (b) actually finding your needs in a reasonable length of time, and at the price you want, and (c) getting the parts when you need them and not six months before or after.

Even the humongous flea market at the Dayton Hamvention doesn't help you if you get the bug to build in June or September. How can you even guess in April that you're going to want to build something in September?

The logical answer to this is to get the flea market exhibitors to advertise their stuff somewhere in a magazine or catalog. Just why hundreds upon hundreds of flea market exhibitors are so blind to the wonders of mail order is a puzzle. I love mail order.

Heck, I started my first mail order business when I was 12 years old and did well at it. That was the Elm Stamp Company. I ran across some of my old ads in a scrapbook recently.

Mail order makes it so you can reach people anywhere in the country and let them know what you've got. Yes, you have to learn about advertising and you have to be merciless in keeping track of which ads and publications pull best for which products. But it sure is nice to see those post office buckets of mail coming in every day, all with checks and charge card info in them. And it's great to have your phone ringing with orders day and night.

I'm selling CDs by mail order through Music/NH. We're also selling book and code tapes through Uncle Wayne's Bookshelf. My wife sells how-to-dance videos and her phone rings with orders day, night and on weekends. Does this bother me? Nope, when she's not around I write down the orders for her and she has them shipped the next day. I love mail order.

I started my Radio Bookshop back in 1958, selling books to hams. It's still going, now called Uncle Wayne's. Lordy, that's 34 years!

If you have any ideas on how to get the hundreds of flea market vendors to get into mail order, please let me know. I'd love to be able to buy things from them the next time the building bug bites. By the time I get to Dayton I'm too busy networking with manufacturers and talking to readers to properly shop the flea market. There's just too much to do in two and a half days.

Perhaps a special advertising section in *73* would help. We might be able to do that two or three times a year to see how it works. How about a "Ham Radio Marketplace" supplement a couple times a year that we send only to subscribers? Heck, we could include it for our *Radio Fun* subscribers too. That would give it a very good circulation.

Let me know if this is something you'd like to see.

Helping Kids

There's a lot of handwriting about the sad state of our youngsters. They're not getting interested in science and math— they're not reading—heck, they can't even talk very well, like. Yes, I agree that our educational system is at fault. It's been shown to be one of the worst in the developed countries. And yes, I have a bunch of ideas on ways to get it turned around.

My proposals for change are radical. They have to be, because all of the efforts to just improve education have failed. In the almost 10 years since the *A Nation At Risk* report billions have been spent trying to improve the system. What they've found is that the system doesn't need fixing, it needs re-inventing.

Now, my question is this. How interested are you in helping to do something about this mess? I've done a lot of homework and have come up with some proposals for a completely new educational system—one I think you're going to like. But just proposing the changes means little—the tough part is getting them implemented. That's going to take some work and clout. Are you into work? Have you any clout? Connections?

Starting From the Beginning

After a good deal of research, plus some thinking, the whole miserable picture of how badly we've been messing up our children finally dawned on me. Oh, I suspected, but I figured I must be wrong. We wouldn't do *that* to our kids! Well we have and are—and it's going to continue unless you and I are able to stop it.

First, I hope you took the time a couple of years ago to watch a PBS movie called "7-14-21-28." It was a film showing interviews with seven-year-old British kids. They asked them what they thought they might do in life. Then they interviewed them again at 14 to see how their lives had progressed by the time they were in their teens. Again they discussed their plans and interests. The third set of interviews with the kids was when they were 21. Now we could really begin to see how firmly their lives had been set when they were seven. The last interviews were when they were 28. This showed even more clearly how well established lifetime patterns are set by seven years old. The film will be shown again soon, complete with interviews at 35 years of age. Don't miss it.

Now we can see that those psychologists have been right who have been claiming that by the time children get into school their minds are already closed to reading and intelligent speech. It makes sense if you know anything about how living things develop. If you interfere at any one stage of development, the whole organism is thrown out of kilter and can never really recover.

With babies we know that without adequate stimulation at the right time the brain fails to build the neuron networks needed to speak, read, and even think very well. Enter Big Bird, who turns out to be a much greater ogre than ever imagined. Yep, "Sesame Street" comes on a villain. Both day care centers and parents have been using "Sesame Street" to keep children sedated. Well, it's great for that. It hypnotizes them with flashing lights and constant action, but it doesn't provide the stimulation children need to build the neuron network in their brains which is involved with dealing with language and thinking. The result is kids that schools are unable to reach—kids without brains developed enough to handle reading, kids with short attention spans who are used to instant gratification, kids who get bored easily and have few enthusiasms or even much of an interest in learning.

The really awful part of this is that once the time has passed for the child's brain to develop during this part of the normal growth cycle, there is no way to completely repair the damage. Children grow their minds and bodies step by step. When a step is skipped or mangled, it's mangled permanently. And that's what's happening when we should be reading to our children. We fared better a couple of generations ago when we listened to the radio. That called for building pictures in our minds—our brains got some work to do and were not fed visual pap, with nothing lasting more than a few minutes. Is it any wonder kids have such short attention spans and find books boring?

Parents who are just too busy to read to their children should at least invest in some children's stories on tape—and I don't mean Dr. Seuss either. My mother read to me while I ate lunch every day. As soon as I learned to read I was hard at it, reading and re-reading the Oz books. I also loved the poetry of Robert Louis Stevenson and Eugene Field, and could recite much of it.

By 10 years old I'd read all the Tom Swift and Tarzan books, Booth Tarkington, Mark Twain, books on flying, and I even loved what few space travel books there were. So when's the last time you read to your children or grandchildren? If they've been poisoned by "Sesame Street" it's probably too late. I've been planning on making some tapes of me reading the Oz books, but maybe I'm ahead of my time again.

If we want kids to get interested in science and amateur radio, they're going to have to be able to read and think. They're going to have to be able to set goals and achieve them. We need these kids as amateurs to carry on for the next generation. We need them to keep our hobby from being blown away by commercial interests. But most of all we need them as potential high-tech career scientists, engineers and technicians to help protect our quality of life in the next century.

Let's say that you're not being your usual contentious self and, for a change, you're agreeing with me. The logical question then is, what can I do about the situation? Heck, I'm just one person. Yep, you're one person—and so am I—and so are a hundred thousand other *73* readers.

Continued on page 76

Father Moran, 9N1MM, Silent Key

Marshall Moran SJ, better know to the amateur community as Father Moran 9N1MM, passed away in New Delhi, India, on April 15, 1992, of heart problems. He was 86 years old.

Father Moran's amateur radio career spanned the history of the hobby, from his first crystal radio in 1918 to his daily appearances on 20 meters (even within days of his death). Although he never held a U.S. amateur license, he was active on the bands from Chicago in the 1920s.

In 1951, Father Moran moved to Nepal to establish the St. Xavier School in an abandoned maharajah's summer palace. He remained there for 40 years. In 1960, he asked for and received the first amateur radio license in Nepal, 9N1MM.

Father Moran made almost 300,000 contacts from Nepal and assisted essentially every visiting ham to get on the air. *[Ed. Note: Father Moran holds a special place in my DXing memories; my first DX contact was with 9N1MM - WB8ELK]*

While not on the air, Father Moran ran the St. Xavier school with its 260 students. He held morning sick call, despite his lack of formal medical training, and he worked tirelessly to improve the education and spiritual well-being of two generations of Nepalese.

Rest in Peace, 9N1 Mickey Mouse. *TNX to the DX Bulletin, April 24, 1992.*

FCC Begins License Revocation Proceedings

The FCC has targeted the amateur Extra class operator licenses of Sandra V. Crane N6TFO (Marina Del Rey, California) and Charles P. Pascal WB6CIY (Culver City, California) for suspension and has begun revocation proceedings. Crane and Pascal were the operators of the California Amateur Radio School in Los Angeles.

Charles Pascal was previously separated from the W5YI-VEC testing program in 1986 when there was a question as to whether his PNP Amateur Radio School might be a profit-making venture. The policy of the W5YI-VEC—which every VE must agree to—is that none of its volunteer examiners may be in the amateur radio business, defined as charging amounts above out-of-pocket expenses. This differs from FCC conflict-of-interest rule 97.515(b) which precludes examiners from manufacturing, preparing or distributing amateur equipment or license preparation material.

Pascal's request to become a VEC in 1988 was denied by the Commission.

Sandra Crane N6TFO was disaccredited as a volunteer examiner in May 1991 after it was concluded that the $150 tuition charged by the California Amateur Radio School for a four-hour amateur radio training course conflicted with W5YI-VEC policy. On April 24, the FCC designated both Crane's and Pascal's operator license for suspension and ordered them to show cause why their station license should not be revoked.

"If either respondent requests a hearing or submits a written statement concerning the suspension, that respondent's suspension will be held in abeyance until the matter is decided. If either respondent does not request a hearing or submit a written statement, that respondent's suspension will take effect 30 days after his or her receipt of this order."

The "Show Cause" order states that the matter will be decided on six issues:

(1.) whether the respondents assisted other persons to obtain amateur operator licenses by fraudulent means;

(2.) whether Sandra Crane improperly examined her daughter for amateur radio licenses;

(3.) whether Charles Pascal improperly participated in the examination of Sandra Crane's daughter on November 12, 1990;

(4.) whether the respondents are qualified to remain a Commission licensee;

(5.) whether one or both station licenses should be revoked; and,

(6.) whether suspension of one or both operator licenses should be affirmed, modified or dismissed.

It has not yet been determined what FCC action will be taken against the volunteer examiners who may have been involved. *TNX W5YI Report, Volume 14, Issue #10, May 15, 1992.*

KV4FZ: Guilty of Telephone Toll Fraud

St. Croix ham operator Herbert L. "Herb" Schoenbohm KV4FZ has been found guilty in federal court of knowingly defrauding a Virgin Islands long-distance telephone service reseller. He was convicted April 24th of possessing and using up to 15 unauthorized telephone access devices in interstate and foreign commerce nearly five years ago.

The stolen long distance telephone access codes belonged to the Caribbean Automated Long Lines Service, Inc. (CALLS) of St. Thomas, U.S. Virgin Islands. Schoenbohm was found to have made more than $1,000 in unauthorized telephone calls—although the prosecution said he was responsible for far more.

According to the *Virgin Islands Daily News*, Schoenbohm, who is also the St. Croix Police Chief of Communications, showed no emotion when he was pronounced guilty of the charges by a 12 member jury in U.S. District Court in Christiansted. The case was heard by visiting District Judge Anne Thompson.

Neither Schoenbohm nor his defense attorney, Julio Brady, would comment on the verdict. The jury deliberated about seven hours. The sentencing, which has been set for June 26, 1992, will be handled by another visiting judge not familiar with the case.

Schoenbohm, who is Vice Chairman of the V.I. Republican Committee, has been released pending sentencing, although his bail was increased from $5,000 to $25,000. While he could receive a maximum of 10 years on each count, Assistant U.S. Attorney Alphonse Andrews said Schoenbohm probably will spend no more than eight months in prison since all three counts are similar and will be merged.

Much of the evidence on the four-day trial involved people who received unauthorized telephone calls from KV4FZ during a 1987 period recorded by the CALLS computer. Since the incident took place more than five years ago, many could not pinpoint the exact date of the telephone calls.

The prosecution produced 20 witnesses from various U.S. locations, including agents from the Secret Service, the U.S. Marshal's Service, Treasury Dept. and Federal Communications Commission. In addition, ham operators testified for the prosecution.

Schoenbohm was portrayed as a criminal who had defrauded CALLS out of hundreds of thousands of dollars. Schoenbohm admitted using the service as a paying customer, said it did not work and that he terminated the service and never used it again. He feels that there was much political pressure to get him tried and convicted since he had been writing unfavorable articles about Representative DeLugo, a non-voting delegate to Congress from the Virgin Islands, including his writing of 106 bad checks during the recent rubbergate scandal.

Most, but not all, of the ham operators in attendance were totally opposed to KV4FZ. Bob Sherrin W4ASX, from Miami, attended the trial as a defense character witness. Sherrin told us that he felt the conviction would be overturned on appeal and that Schoenbohm got a raw deal. "They actually only proved that he made $50 in unauthorized calls but the jury was made to believe it was $1,000."

Schoenbohm's attorney asked for a continuance due to newly discovered evidence but that was denied. There also is a question as to whether the jury could even understand the technology involved. "Even his own lawyer couldn't understand it, and prepared an inept case," Sherrin said. "I think he was railroaded. They were out to get him. There were a lot of [ham] net members there and they were all anti-Herb Schoenbohm. The only people who appeared normal and neutral were the FCC. The trial probably cost them a million dollars. All his enemies joined to bring home this verdict."

Schoenbohm had been suspended with pay from his police department job since being indicted by the St. Croix Grand Jury. His status will be changed to suspension without pay if there is an appeal. Termination will be automatic if the conviction is upheld. Schoenbohm's wife was recently laid off from her job at Pan Am when the airline closed down. Financially, it could be very difficult for KV4FZ to organize an appeal with no money coming in.

The day after the KV4FZ conviction Schoenbohm, who is the Republican Committee vice chairman, was named at a territorial convention as one of eight delegates to attend the GOP national convention in Houston this August. He was nominated at the caucus even though his felony conviction was known to everyone. Schoenbohm had even withdrawn his name from consideration since he was now a convicted felon.

The *Virgin Island Daily News* later reported that Schoenbohm will not be attending the GOP national convention. "Schoenbohm said he 'came to the conclusion that my remaining energies must be spent in putting my life back together and doing what I can to restore my reputation. I also felt that any publicity in association with my selection may be used by critics against the positive efforts of the Virgin Islands delegation.'"

Schoenbohm has been very controversial and vocal on the ham bands. Some ham operators now want his amateur radio license pulled—and have made certain that the Commission is very much aware of his conviction. *TNX W5YI Report, Vol. 14, Issue #10, May 15, 1992.*

An Indoor or Window-Mounted Vertical Dipole

A floor-to-ceiling antenna for 10-20m.

by Robert H. Johns W3JIP

With a spring-loaded center insulator and rubber tips at the ends, this antenna is held by friction against the floor and ceiling, and is self-supporting. Its parts are less than three feet long and the coils fold up, so it stores nicely. You can also mount it temporarily on a window frame or railing and operate it outdoors.

When set up in a room with an 8-foot ceiling, the antenna is a full half wave on 10 meters, with end capacity hats making up for the lack of vertical length. On lower frequency bands, part of the large split loading coil shown in Photo B is connected into the antenna with an alligator clip. This coil resonates the antenna from 12 to 20m.

Construction Details

Only one loading coil? Yes. This means that the antenna is fed off-center. Even though the coaxial connector is in the middle of the vertical section, the element with the coil in it is electrically longer. The feed point impedance is also higher as a result of the off-center feed. This is convenient, since the impedance of a loaded antenna is often too low for a good match to 50 ohm coax. The two effects nicely balance here, giving this short antenna a low SWR on all bands so that no tuner is needed. Off-center feed is a useful trick for short-loaded antennas.

Since the coils for an indoor antenna are not exposed to the weather like an outdoor antenna, or to the wind load like a mobile whip, it's possible to get much greater Q and efficiency by making the coils big. This is a chance to reclaim some of the losses inherent in indoor operation!

The coils in the photos are approximately 8" in diameter, made from #8 aluminum wire. If you are wondering how in the world you might wind such monsters, have no concern. You can purchase the wire already wound to the proper diameter. Aluminum ground wire (Radio Shack #15-035) comes in 40-foot lengths, and coiled to this diameter. Building the coil requires preparing the PVC insulating ribs and cutting off the proper number of turns of aluminum wire, and then bolting the ribs around the turns of the coils.

This same wire is also used for the capacity hat rods at the ends of the antenna. All of the parts of the antenna are either hardware store or Radio Shack items.

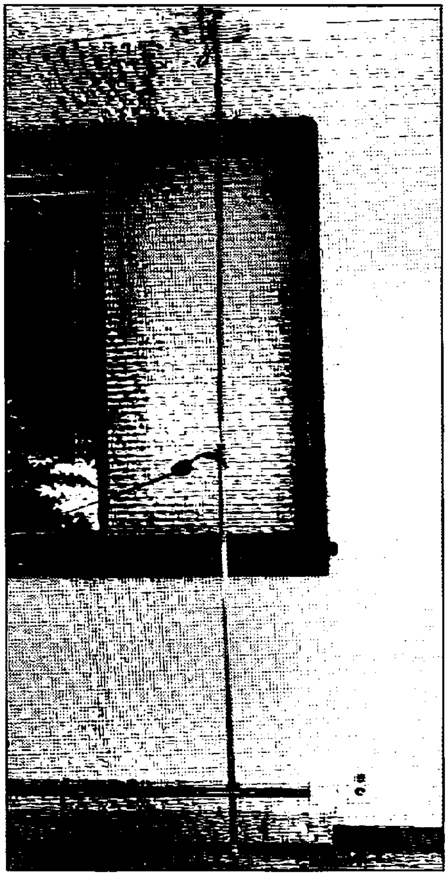


Photo A. The vertical dipole presses against the floor and ceiling to stay in position.

The folding feature comes about because there are only two ribs or supports for the turns, on opposite sides of the coil. They allow the coil wire to twist relative to the plastic ribs when the coil is flattened, as shown in Photo C. However, there is still enough grip on the wire to support the turns in a horizontal position out from the antenna when the coil is opened out again.

The outer end of the aluminum coil is connected to the antenna element via a short length of flexible wire to a ring terminal on its mounting bolt. This short wire connects to the coil by another ring terminal which is bolted to the end of the coil.

The capacity hat rods are three feet long and are attached to the antenna by inserting them into holes (#30 drill) 1/4" apart, through the end of the aluminum tubing element, as shown in Photo B and Figure 1. The rods are held in place by a 5/16" nut that slides over the two rods and then is threaded onto them to tighten them, as shown in Photo B.

Use two lengths of tubing that telescope to make each element adjustable in length. The antenna will fit against ceilings about 7.5 to 12 feet high. The larger center segments are 3/4" in diameter with a 0.048" wall, three feet long. This size of aluminum tubing is available from hardware departments. The thinner end segments are 5/8" in diameter, also three feet long. Some hardware stores carry this size, but not many. An alternate source is aluminum clothesline poles, from hardware or home building supply stores. These are 5/8" in diameter with a thinner tubing wall, about 0.030". The antenna in the photos uses this material.

One end of each 3/4" segment is slotted and tightened around a 5/8" segment by a hose clamp.

A 3.5" length of the 5/8" aluminum tubing at the tip of each element is separated from the rest of the element. This insulates the capacity hats from the elements. The insulator is a 1/2" CPVC (not PVC) pipe coupling, which is a tapered snug fit around the 5/8" tubing. Gently hammer the two tubes into the coupling and secure them with #8 x 1/2"-long sheet metal screws, as shown in Figure 1. A clip lead about 12" long is attached to the inner element tubing by a 6-32 x 1" bolt and nut. This alligator clip is the adjustable connection to the loading coil, or to the C-hat when no coil is in the antenna.

The center insulator is a 5/8" hardwood dowel, 8" long (see Figure 1 and Photo D). The SO-239 coax connector is mounted by means of 1"-long 6-32 steel bolts. Drill out two of the holes in the connector with a 9/64" bit to provide clearance for the bolts, then solder a 4"-long wire to the center terminal of the SO-239. This will pass through a hole in the dowel and connect to one of the elements by a 6-32 bolt securing the 3/4" aluminum tube to the center insulator, as shown in Photo D.

The heavy spring (C-263, Century Spring

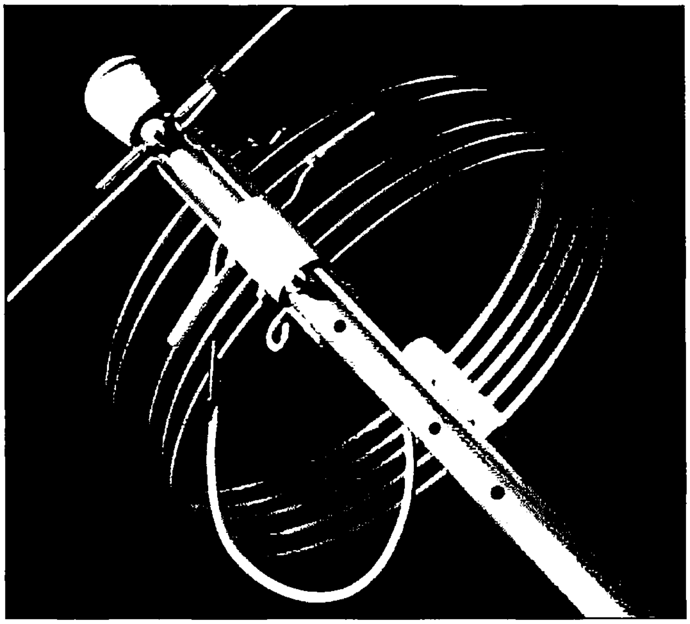


Photo B. The 8" diameter split loading coil has spaced turns so that a clip lead can tap into any point in the coil. The capacity hat rods are each 3 feet long. They are held in place by the large nut around them located near the tip of the element.

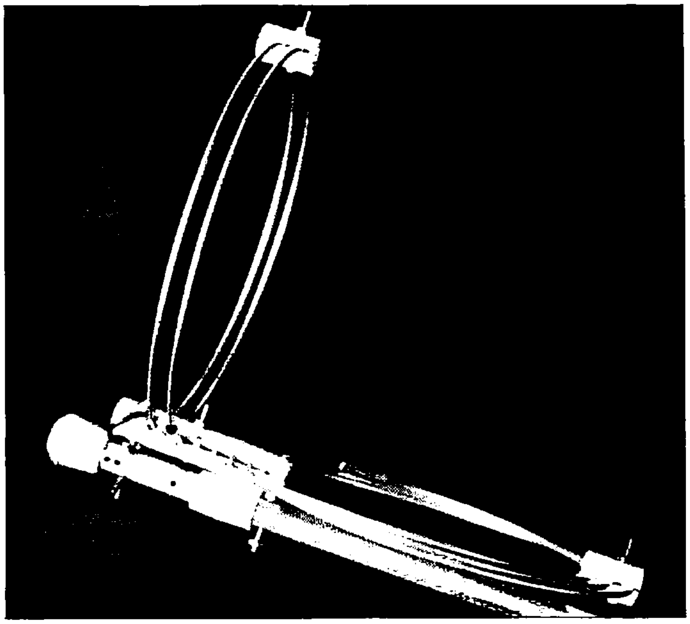


Photo C. Only two turns of the loading coil are connected into the antenna. Three turns are disconnected by sliding away the sleeves that are visible in Figure 2, and the three turns are folded down beside the element. Both coils fold for easy storage.

Corp., in a hardware store spring assortment) is a loose fit around the 5/8" dowel. This spring needs to be stretched so that the turns are spaced apart, as shown in Figure 1-b, and cut with a file or grinding wheel. It is threaded around one of the bolts that supports the coax connector so that it stays in place on the center insulator. With this compression spring in place, electrical contact to the second element of the antenna is made when the tubing is pressed against the spring.

All of the coil supports are made from 1/2" PVC Schedule 40 pipe. The turns of the aluminum coil are held in place by slots in the ribs made by drilling holes (9/64") on 3/8" centers into the pipe, and then sawing the pipe lengthwise through these holes. When the two halves of the pipe are bolted together again, with one turn of the coil in each slot, the coil turns are spaced properly and gripped by the rib. Figure 1 shows side views of coil ribs and the 6-32 x 2" bolts used to mount the coils to the antenna. You also need to drill 9/64" holes for these bolts in both the ribs and the aluminum tubing they mount to.

The 5-turn coil for 12-20m is made in two separate pieces that can be spliced together. The 2-turn coil is used for 12 and 15 meters with the 3-turn coil disconnected and folded down, as shown in Photo C. For 17 and 20 meters, the 3-turn coil is pulled up beside the 2-turn coil and they are spliced together by aluminum sleeves made from 1/4" o.d., 7/32" i.d. tubing, available from hobby stores. These two splices are visible in Photo B, which also shows the ends of the coils bent to bring them next to the adjacent coil.

To assemble a coil, bolt two rib halves together loosely at one end. Slide the aluminum sleeves onto the coils, and then put the aluminum wire between the half-ribs, with one turn in each slot. Hand-tighten the nut to keep the coil turns in the slots and add the remaining bolts to clamp the rib together. Use wing nuts to attach the coils to the elements. Connect the free eyelet of the solder lug at the top (as shown in Figure 1-a) to the outside end of the 2-turn aluminum coil. Bend the #8 wire into a tight loop that will allow a 6-32 x 1/2"-long brass screw to pass through. A #6 brass or stainless steel finishing washer will take a good bite into the aluminum wire and also wrap around it. Bolt the eyelet, the end of the aluminum wire, and the finishing washer together.

Operation

To set the antenna up between floor and ceiling, the length of the vertical section is adjusted with the hose clamps on the telescoping sections. The antenna is made about 1/2" to 3/4" too long, so that it tilts when held against the floor and ceiling. Then push down on the top section to compress the spring and bring it to a vertical position. The

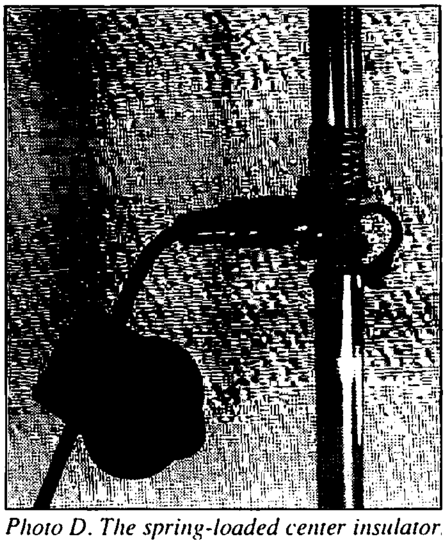


Photo D. The spring-loaded center insulator. Use a current balun (RF choke) at each end of the coaxial cable. The one shown has 5 turns of RG-58 coax wound on ferrite cores (Radio Shack 273-104).

Photo E. The indoor vertical dipole can be window-mounted for better performance. A first-floor window was used for the photo, but the antenna should be as high and clear as possible. Extra coils with 5 turns (top) and 10 turns (bottom) may be added to the antenna, as shown here, for operation on 30 and 40 meters.

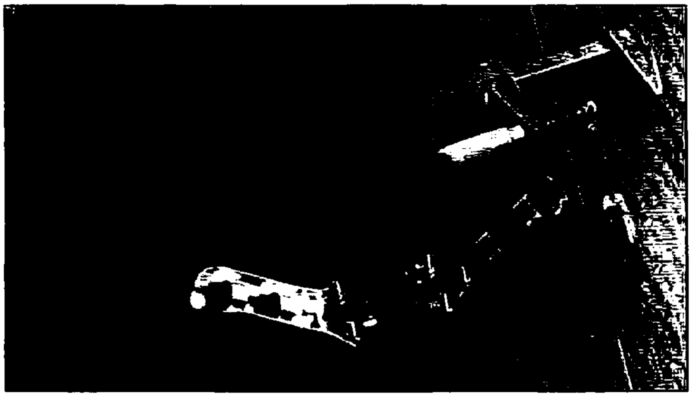


Photo F. The mounting hardware consists of 3/4" flagpole brackets on a board, and an 18" C-clamp that attaches to the board with a large hose clamp.

5/8" rubber furniture tips (not plastic) will hold it securely and not mark the floor or ceiling. Frequency changes are easier to make if the end with the coil is placed near the floor.

Table 1 gives the approximate number of turns to use for each band. These will vary, depending on how much metal in the building is close to the antenna, and on the height of the ceiling. The small increase in the number of turns from 15 to 17m is because the 3-turn coil must be connected and placed next to the 2-turn coil. This adds inductance from the mutual coupling.

When trying out the antenna for the first time or setting up in a new location, check the SWR across a band. This will tell you if an adjustment is needed. If the SWR is lowest at the low edge of a band, the antenna is too low in frequency. Remove some coil from the antenna by moving the tap (clip lead). If the SWR is best at the high end, add more coil. You are aiming to have minimum SWR where you operate in a band.

On 10 meters where no coil is used, the clip lead must connect the element to the outer tip in order to have the C-hats in the antenna. If the 10 meter frequency is too low, raise it by pushing in the C-hat rods so that they overlap and don't extend out as far.

An important part of this antenna system is a good RF choke, or current balun, to isolate the antenna from feedline currents. Especially with off-center feed, the coax will become part of the antenna if you connect it directly to the antenna without a choke. This will be seen as SWR and resonant frequencies that change with cable location, RF feedback (shocks from the radio knobs and squeals from its speaker), and inconsistent results. Use a ferrite-bead coax-shield choke (as reviewed by John Belrose in "Transforming the Balun," *QST*, June 1991, pp. 30-33) or an RF choke formed by winding the coax on ferrite cores as in Photo D.

Outdoor Operation

There are many options for portable operation of this antenna. If you bolt the removable element to the center insulator so that it contacts the spring, you can use the antenna as a horizontal dipole or hang it from a tree as a vertical dipole. You can also put the dipole outside for better efficiency, mounted on a windowsill or railing, as shown in photos E and G.

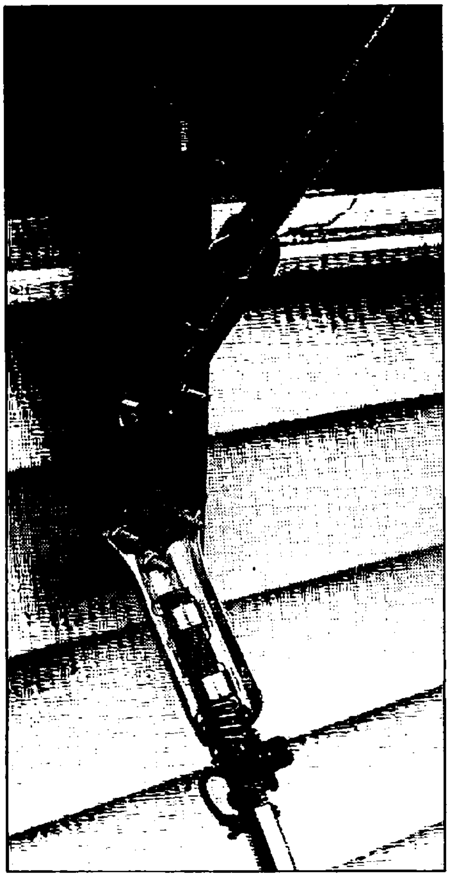


Photo G. A closer view of the window mount in operation. Notice that the indoor dipole's coax connector and center insulator are used here also. The compression spring fits into the mounting bracket and is the electrical connector to one element of the dipole.

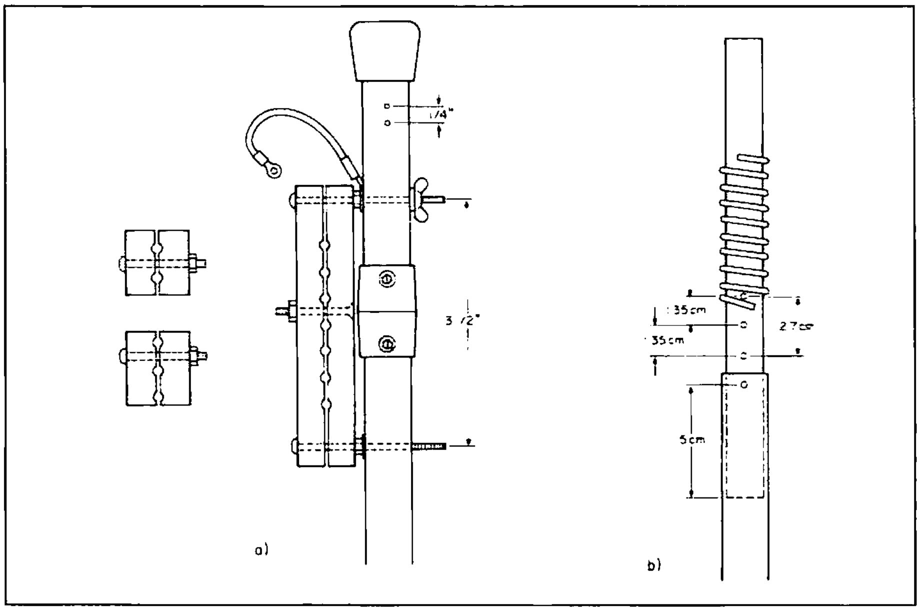


Figure 1. Sketch a) shows the ribs of the coil for 12 through 20 meters, mounted on the antenna. The slots that grip the turns of the coil are made by drilling 9/64" holes in the plastic pipe and then sawing the pipe in two, through the holes. All the bolts are 6-32, preferably brass. The longer ones are 2" and the shorter ones 1". The holes for the bolts are also 9/64". Sketch b) shows the holes to be drilled in the center insulator. These are for mounting the SO-239 connector and for bolting one element to the center insulator.

The two elements, held in a 3/4" flagpole bracket switch, are mounted on a base and clamped to a window or railing with a large carpenter's clamp (see Photos F and G). These are all hardware items. The base can be wood (1" x 3" x 12") or a rigid plastic such as PVC or Plexiglas (1/2" x 3" x 12"). With your flagpole brackets as guides, drill the mounting holes shown in Figure 2, and countersink them so that flathead mounting bolts (3/16" x 1") won't scratch the window frame. The 1/4"-wide, 1"-long slot in the mounting base is for the spine of the long clamp. When the spine is in the slot and a large hose clamp is tightened around the clamp head and the board, they are held securely together.

There are four 3/16" holes for each bracket, even though a bracket mounts with only three. The extra one lets you mount the bracket at right angles to the way they are shown in the photos. This can be used for a horizontal mounting of the elements (first floor apartment) or to clamp the mounting base to the side of the window frame. The antenna can also be clamped to a post or a small tree, as well as a railing. The carpenter clamp and flagpole brackets make a very versatile

Continued on page 64

Six-Band Linear Trap Antenna

Multiband operation without coils or capacitors.

by J. Frank Brumbaugh KB4ZGC

Trap dipoles using L/C traps require careful choice of components and adjustment before use. Traps must be waterproofed, and they add extra weight and wind resistance to the flat-top dipole. Components used to construct the traps are an added expense. They also make the antenna more visible where it might be best not to advertise the existence of an antenna.

The linear trap dipole described here is constructed entirely of wire—no coils or capacitors are needed. Any adjustment needed can be done with a pair of diagonal cutters. From a slight distance it is no more noticeable than a single-wire dipole. Less than 175 feet of wire are required, and it provides an isolated half-wave dipole on 40, 20, 17, 15, 12 and 10 meters.

Theory of Operation

The flat-top is a half-wave 40 meter dipole. At five measured points along each half of this dipole single insulated wires, each a quarter-wave long on 10, 12, 15, 17 and 20 meters, are soldered. After trimming to the desired portion of each band, these insulated wires are bundled along the 40 meter dipole with the free ends towards the central feed point. The assembly is then held together neatly with nylon wire ties.

These quarter-wavelength wires, along with the part of the 40 meter dipole along which they extend, become quarter-wave stubs. Because the end of the stub soldered to the main dipole is shorted, the impedance transfer presents a very high impedance at the open end, thus isolating the remainder of the outer ends of the dipole at the position of the open end of the stub. Thus, a half-wave dipole on each band is provided.

Construction

Figure 1 illustrates the layout of one half of the 40 meter dipole. For clarity, the quarter-wave insulated wires are shown expanded. Dimensions are given calculated for the low frequency edge of each band.

The points on the flat-top, identified as A through E, are where the insulated wire stubs are attached and soldered.

Table 1 gives the length of each of the quarter-wave wires, also identified as A through E. Each is connected to the dipole at the point identified by the same letter. There are two insulated wires for each lettered point, one for each half of the 40 meter dipole.

Cut and strip one end of a pair of insulated wires—the wire gauge is not important—of length A from Table 1. Solder the stripped end of each wire to the two points marked A.

Continue as just described until you have connected the proper insulated wire pairs to points B through D on each half of the dipole. *Do not attach wires to point E at this time.*

The wires at point E will be attached only after the 40 meter dipole has been adjusted to length, so at this time use tape or string to bundle the insulated wires temporarily to each side of the dipole with the open ends extending towards the central feed point.

Adjustment

Step 1. Feed the antenna with a small amount of RF through an SWR meter at some frequency in the 40 meter band where you usually operate. The SWR will probably not be 1:1.

Step 2. Shorten each end of the 40 meter dipole by the same amount, an inch or two, and recheck the SWR.

Step 3. Continue repeating this step until the SWR is as close to 1:1 as possible.

Step 4. Check SWR across the band to determine the 2:1 SWR bandwidth.

Step 5. Attach insulated wires at point E at each end of the 40 meter dipole, and solder. Bring this wire along the flat-top towards the feed point. Use nylon wire ties to bundle all wires neatly against the flat-top.

Step 6. Feed the antenna as described in Step 1 in the 20 meter band.

Step 7. Remove the RF and shorten the open ends of both point E wires an inch or two, and repeat Step 6, for the lowest SWR.

8. Continue repeating Steps 6 and 7 until the SWR is as close to 1:1 as possible.

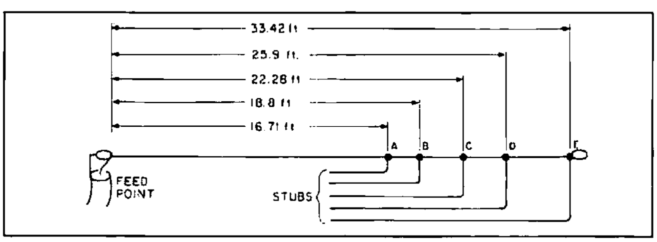


Figure 1. Stub attachment points on one-half a 40 meter dipole.

9. Check across the 20 meter band to determine the 2:1 SWR bandwidth.

10. Repeat Steps 1, 7, 8 and 9 in the 17 meter band, carefully shortening both wires connected to point D.

11. Repeat Step 10 in the 15 meter band, shortening both wires connected to point C.

12. Repeat Step 10 in the 12 meter band, carefully shortening both wires connected to point B.

13. Repeat Step 10 in the 10 meter band, carefully shortening both wires connected to point A.

This completes construction of the linear trap dipole.

Installation

As long as you remember the truism "higher is better," this antenna can be installed as a flat-top, a sloper or an inverted "V." Although it is somewhat more broadband than a trap antenna using L/C traps, the 2:1 SWR bandwidth may shift somewhat up or down in frequency when the antenna is installed in its permanent position. It is unlikely to require further trimming of the quarter-wave wires.

For the purist, attachment points A through D can be moved slightly closer to the feed point during adjustment to further reduce the SWR, although without this refinement the SWR should be below 1.5:1 over a fairly wide range on each band.

Although this antenna is designed to cover the bands from 40 through 10 meters, it is not possible to include the 30 meter band. Each half of the lowest frequency dipole must be at least one half-wave long at the next highest band, so the 30 meter band can be included only if this antenna is expanded to cover 80 meters.

If there is insufficient space for the full flat-top length, the ends of the dipole can be dropped down vertically or at right angles to the horizontal portion with very little loss of capability. Both ends should be dropped the same amount, of course.

For those hams who have space for a long-wire antenna, this linear trap design can be applied at one end of the long wire. Constructed in this manner, a long-wire antenna will be fed at a low impedance point on each band since it will effectively be fed one quarter-wavelength

Table 1. Stub Lengths	
Point	Length (feet)
A	8.37
B	9.40
C	11.14
D	12.95
E	16.72

from one end, thus eliminating the need for an antenna tuner.

For those hams using rigs incorporating automatic tuners, an SWR of 1:1 is possible with this antenna on all bands covered, with the possible exception of the very wide 10 meter band.

However, if carefully adjusted as described herein, no antenna tuner should be needed, although one can be used if desired to achieve a broader bandwidth at low SWR. It is also probable that an antenna tuner will match this antenna in the 30 meter band, although this has not been attempted here.

Conclusion

With three insulators, a feedline, less than 175 feet of wire and some minor clipping of wire ends with diagonal cutters, you can have an effective isolated dipole on six of the best DX bands. It does not require an antenna tuner and it is probably the simplest and cheapest multiband antenna which can be constructed by any ham.

10 Meter DSB Transmitter

Easy to build and no tuning required.

by Carl Lyster WA4ADG

Here is an ideal construction project: a no-tune, 1-watt output, CW/double-sideband transmitter which is a breeze to build, and low cost to boot! The heart of this unit is a small precision oscillator that is used as a 28.322 MHz clock on computer video cards, and is available at a cost of only a few dollars. How convenient!

Bill Brown WB8ELK alerted me to the availability of this jewel and asked if I could come up with a simple DSB transmitter. Never being one to turn down an interesting challenge, I decided to design a simple but versatile unit that could be used in DSB as well as CW modes. In order to keep cost to a minimum, I chose to use readily available parts and incorporate some of the latest technology components in the design, along with a whopping $1.50 final transistor! The total cost, including commercially made PC board, is about $25.

I hope a large number of experimenters take this project to heart and that the frequency of 28.322 MHz becomes a new breeding ground for tinkering-minded hams. *[Ed. Note: Other frequencies can be custom ordered - see the Parts List for details.]*

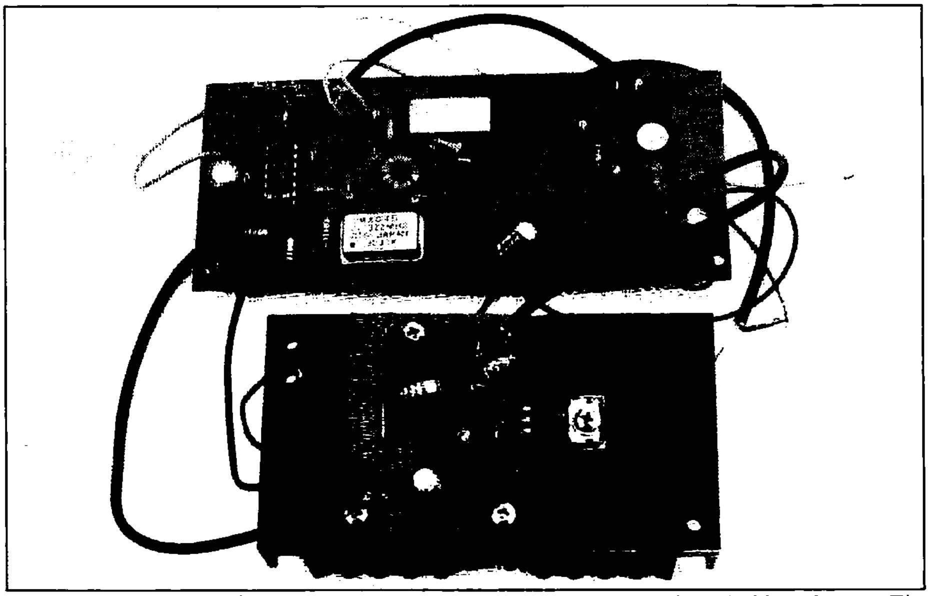


Photo. The 10 meter DSB transmitter. The main transmitter is capable of 100 milliwatts. The small amplifier board will provide you with a 1-watt output.

Why Double-Sideband Suppressed Carrier?

This question is all a matter of dollars and sense. The traditional SSB transmitter requires some form of expensive filter to remove the undesired modulation sideband and pass the desired one on to the remaining electronics. Of course there are ways to produce an SSB signal that does not require a crystal filter. I have seen articles on "rolling your own" filters from cheap surplus crystals, but all of these methods are well beyond the capability of the beginner. The old adage "Keep it simple stupid" certainly applies here; we don't want people getting "Pink Tickets" from the FCC because their home-brew transmitters are contaminating the air waves.

It is true that double-sideband modulation consumes extra spectrum space. I would not even consider building a DSB transmitter for any frequency below the 10m band. DSB modulation has several advantages that make it the ideal choice for this project. First, a DSB signal can be received by all who own DSB or SSB receivers. I have read that a direct conversion receiver will not receive DSB signals, but this is a minor concern. Second, a DSB suppressed carrier signal is more efficient than simple AM modulation. Third, and most important, a DSB signal is very easy to generate! *[Ed.note: Please note that you need at least a General class license to operate DSB.]*

DSB Suppressed Carrier Modulation

To understand DSB suppressed carrier modulation, a quick review of its close cousin, AM modulation, will help. In AM, a carrier is modulated by varying the amplitude of the RF signal at an audio rate; this can be accomplished by the use of a modulation transformer or by modulating the DC power applied to a low level amplifier stage in the transmit chain. The resultant signal is a mixture of the original RF frequency plus (the sum of the RF frequency and the audio frequency) and (the subtraction of the RF frequency and the audio frequency). These sums and differences are referred to as the upper and lower sidebands, respectively. They contain all of the intelligence associated with the AM signal; the presence of the carrier is simply wasted energy. It would be much more efficient to eliminate the carrier and devote the entire transmitter power to the sidebands. This is precisely what is achieved with DSB suppressed carrier modulation. Due to the fact that both sidebands are mirror images of each other, they contain the same information. For even greater efficiency, we could eliminate one of the sidebands by the use of an expensive crystal filter, and transmit a single sideband signal. However, for our simple transmitter we shall be content with a low-cost DSB signal.

Circuit Operation

It would be easy to breeze through this section with only a cursory description of the circuit functions, however I would feel like I was cheating you if you did not fully understand the operation of what you were building. Part of the appeal of ham radio is learning the innermost secrets of the equipment that you are operating, so I shall endeavor to explain the purpose of each and every component in this device! See Figure 1 for the schematic.

The Oscillator Section

The oscillator module produces a 4-volt peak-to-peak square wave at 28.322 MHz, which is the carrier frequency. The output of the oscillator is capacitively coupled to transformer T1 by capacitor C1. Only a small portion of the 4-volt signal is needed, so resistor R1 reduces the level applied to T1. T1 serves an unusual function in this circuit. It is used to convert the square-wave output of the oscillator into a sine wave. This is accomplished by the resonant action of T1's primary and capacitor C3. The sharp

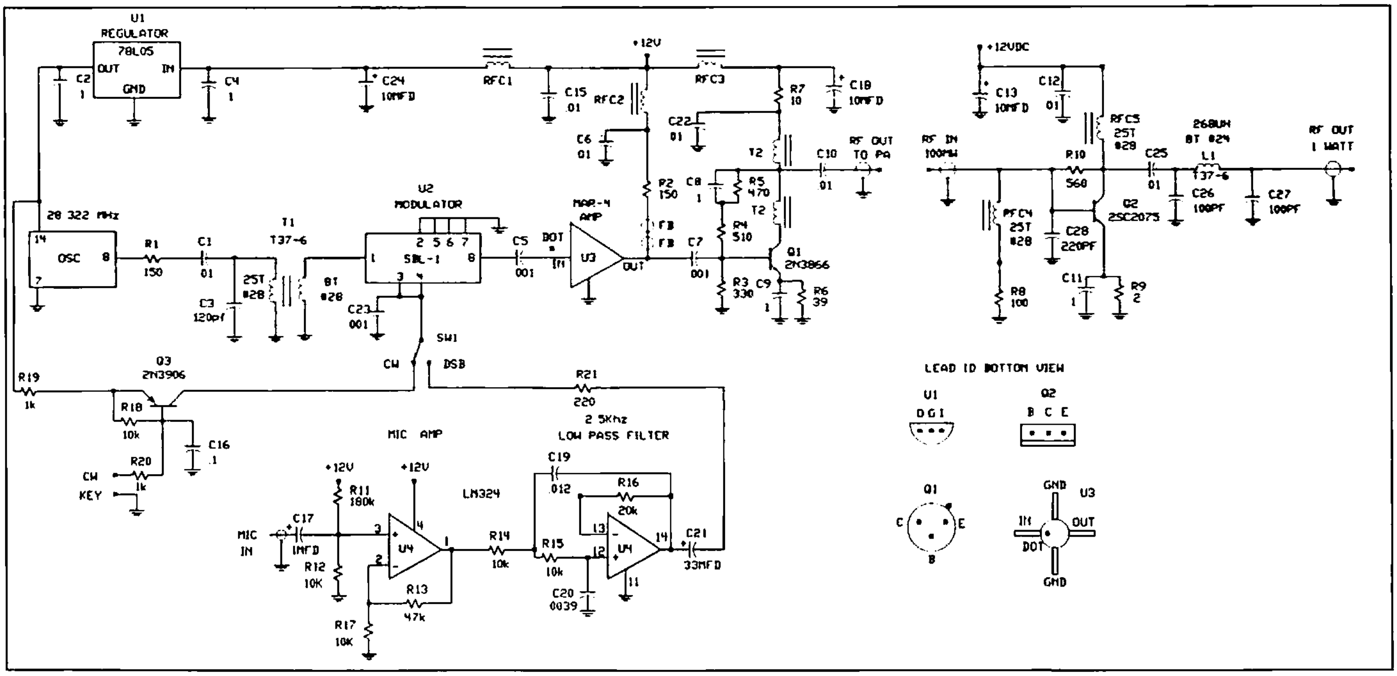


Figure 1. Schematic diagram of the 10 meter DSB exciter board and the optional 1-watt power amplifier.

spikes which occur at each half cycle of the square wave, coupled into T1 by C1, excite the primary and store energy in the toroid core. The resonant properties of T1's primary and capacitor C3 convert the stored energy into a very respectable sine wave which is coupled out of T1 by the 8-turn secondary.

I actually built a transmitter without this square-to-sine-wave converter and it performed very well. However, I was able to detect an increase in carrier suppression with the converter in place. These three parts are a small price to pay for increased performance.

The Mixer Section

Across the secondary of T1 is approximately 0.6 Vp-p, which is applied to the double-balanced mixer module U2. The mixer is one of the "high-tech" devices used in this design. It replaces a handful of transformers and matched diodes with a small package, pretested and guaranteed to meet published minimum specs. From the mouth of experience I can tell you that trying to "roll your own" double-balanced mixer is no fun! These devices are true marvels and have many different uses.

I have exploited two different properties of double-balanced mixers in this circuit: the traditional use as a mixer for the generation of DSB, and as a controlled attenuator for the generation of CW. Switch S1 selects the signal source that is fed into the IF port of the mixer.

The IF port is connected to the diodes which form the active portion of the mixer. In DSB mode, audio is directed into the mixer diodes from the audio amp and filter composed of IC U4. With no audio voltage present at the diodes, the mixer does not pass the carrier energy on to the remaining stages. When audio drive is applied to the diodes, they begin to conduct and perform their function as a balanced mixer.

The amplitude of the sideband energy output is proportional to the audio drive input. The carrier is removed by the action of the mixer; only the sidebands are contained in the output.

The term "carrier suppression" is a ratio of the energy output of the mixer with full audio drive applied, and the output of the mixer with no audio drive applied. Carrier suppression is expressed in dB and can be considered as a "quality factor" in comparing the performance of various types of mixers. This transmitter has attained a measured carrier suppression of 45 dB, which is a very impressive performance for such an inexpensive circuit. I have spent long hours improving this circuit to achieve such a level, one

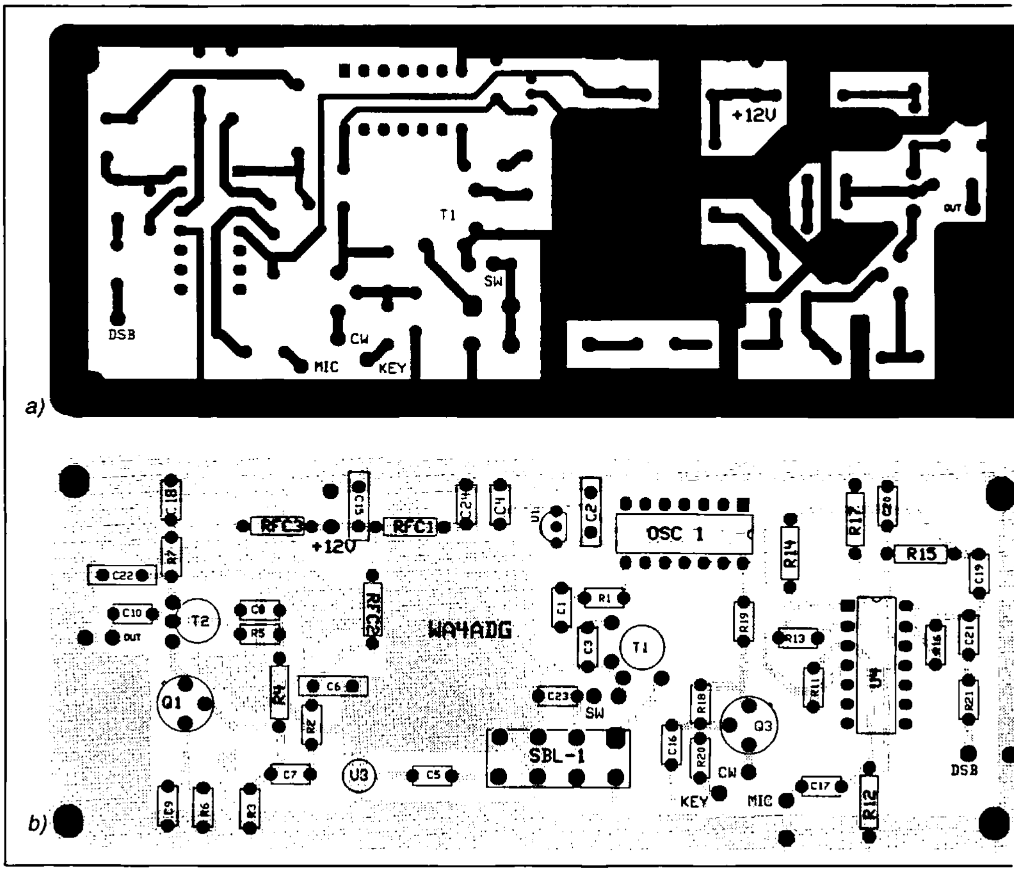


Figure 2. (a). PC board foil pattern for the main DSB exciter. (b). Parts placement.

that exceeds many commercially manufactured pieces of equipment.

CW Mode

In CW mode, transistor Q3 is keyed on and off by a CW key closure to ground. Q3 is held turned off by R18. When the key is closed R20 passes current to ground and lowers the voltage at the base of Q3, which places the base at a lower plus potential than the emitter. Q3 then turns on and supplies about 5 mA of current, limited by R19, to the diodes of the mixer. The double-balanced mixer now functions as a variable attenuator with its output proportional to the applied current. The chosen current level of 5 mA turns the mixer/attenuator fully on—a higher current level will damage the mixer diodes.

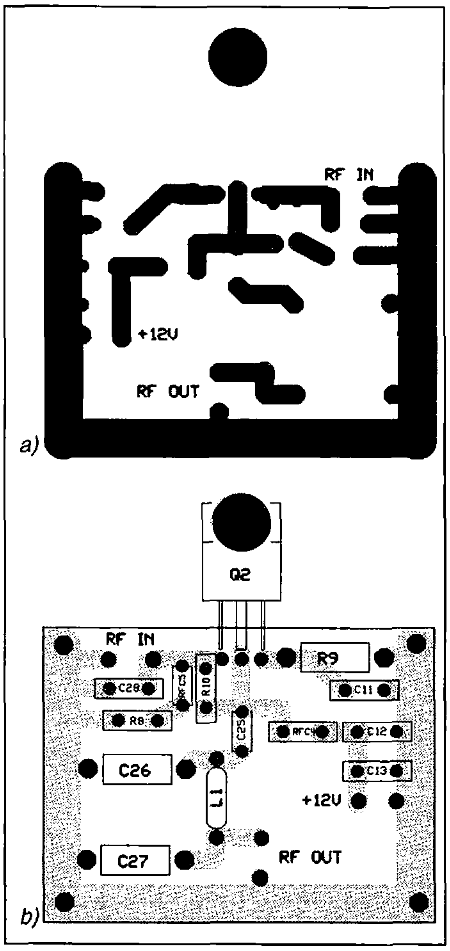


Figure 3. (a). PC board foil pattern for the 1-watt power amplifier board. (b). Parts placement.

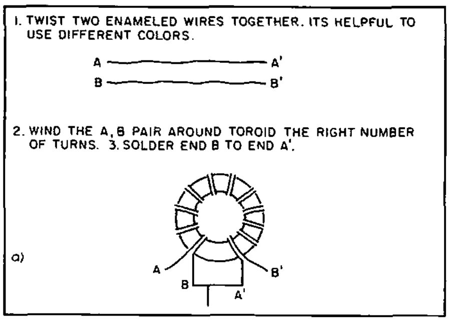


Figure 4. Bifilar winding details for toroid T2.

One modification I considered, but did not show on the schematic, is the installation of a 10k pot in series with R19. This pot would function as a drive control. I added this pot to my prototype and it performed very nicely; the power control was smooth and provided excellent control of the generated CW signal. C16 functions as a key click filter for transistor Q3, and capacitor C23 was added to bypass any carrier energy to ground that may appear at pins 3 and 4 of the mixer. Only audio in DSB or DC in CW mode should be present at this point. The addition of C23 made a noticeable improvement in the carrier suppression on my test models. This is another one of the parts which is not necessary for operation, but its presence improves the performance as measured with expensive test equipment.

The Audio Amplifier

The audio input from an electret microphone is amplified in the first section of IC U4 by a factor of five. Resistors R13, R17 and R12 set the gain to 5, while R11 and R12 form a voltage divider that applies a DC offset of 0.63 volts to the input of the op amp. About 100 mVp-p of audio from the microphone is capacitively coupled by C17 into the op amp. The gain of 5 amplifies the audio as well as the DC offset from the voltage divider, and results in an output at pin 1 of 0.5 Vp-p audio with a DC offset of about 3.15 VDC. This offset is necessary in order to use a single voltage supply op amp. By biasing the output of the op amp at one fourth of its DC operating potential, the required audio level of 500 mV is guaranteed to be free of distortion that might be caused by clipping of the audio signal if it were to approach one of the supply rails.

The second section of U4, used as a low-pass filter to limit the bandwidth of the generated DSB signal, is dependent upon the highest modulating frequency applied to the mixer. In human male voices, maximum energy is contained in the 300 Hz region of the audio spectrum, while for female voices, maximum energy is contained at about 3000 Hz. Since the DSB signal already consumes twice the precious spectrum space of a typical SSB station, a compromise must be struck on the maximum allowable audio frequency passed to the DSB mixer. I have chosen this limit to be 2500 Hz, which will provide excellent reproduction of the male voice and still provide faithful rendition of female voices. The driving concern here is to maintain a manageable bandwidth in the DSB signal that will cause a minimum of interference with others operating SSB equipment. Resistors R14, R15 and R16, in conjunction with capacitors C19 and C20, form a second order low-pass filter with a 12 dB per octave rolloff, starting at 2500 Hz. C21 is a DC-blocking capacitor which passes the audio from the amp/filter to the mixer via SW1. R21 reduces the 500 mV of audio drive to about 300 mVp-p for injection into the mixer.

MMIC Stage

Capacitor C5 is a DC-blocking capacitor which couples the DSB or CW signal from the output of the mixer to the input of IC U3, a monolithic microwave integrated circuit, or MMIC for short. This amplifier is one of a series of ICs sold by Mini-Circuits, who also manufactures the double-balanced mixer. The MAR-4 MMIC used here is rated at about 10 dB of gain and an output power of 10 mW. It replaces a small handful of parts at a cost of only $2, all contained in a package the size of a pencil point! The body of this part contains a yellow dot over the input lead, while the opposite lead is the output and the two adjacent leads are both ground. Devices such as the MAR-4 MMIC are going to play an ever-increasing role in future ham construction projects. I have purposefully used one here to introduce the new hobbyist to this class of devices. They require care in handling and soldering due to their small size, but I have found them to be tougher both physically and electrically than one might expect.

The output of the MAR-4 is also the DC input pin, and this is accomplished by the RF choke feed composed of two ferrite beads in series with the current limiting resistor R2. Ample use of bypass capacitors is used throughout the transmitter on the power supply lines to insure that no stray RF is coupled from stage to stage by these lines. Bypass caps C4 and C2 are placed on the input and output pins of the 5-volt regulator U1 to prevent internal oscillations in the regulator chip. The +5-volt supply is used by the oscillator module, and is also used to supply the switched DC current to the mixer diodes in CW mode. Capacitors C18, C6, C13, C22, C24, C15 and C12 all function as supply line bypass capacitors. Their assortment of values insures that all frequencies from audio to RF on the supply lines will be effectively bypassed to ground. Several RF chokes are used throughout the transmitter to help isolate the supply lines of the different stages. This provides further protection from stray coupling that could lead to self-oscillation in the amplifier chain, and a certain "pink ticket"!

The Class-A Broadband Amplifier

Capacitor C7 couples the amplified signal from the MAR-4 to the base of transistor Q1, a low level class-A broadband amplifier. The stage gain of Q1 is set to about 13 dB by feedback action of C8 and R5, while R3, R4, and R6 set the bias to insure class-A operation. Transformer T2 is a broadband coupling device used to provide a coarse match to the final amplifier transistor Q2. R7 is a current limiting resistor, and C9 serves as the emitter bypass cap. The output level of Q1 is about 100 mW and is coupled to Q2 via C10. *[Ed. Note: You can operate quite effectively at this power level if band conditions are good. Use of the optional 1-watt amplifier will allow you to work just about anyone. Don't expect to break through DX pile-ups, however.]*

The Final Amplifier

The optional final amplifier is also operated class-A to insure linearity. This results in a substantial amount of heat dissipation by the transistor; therefore, Q2 is fitted with a heat sink. The power amplifier is built on a separate PC board to allow easy attachment to whatever form of heat sink you wish to use, such as a chassis box or plate of aluminum. The tab of Q2 must be insulated from the heat sink due to the fact that the tab is internally connected to the collector. Resistors R10, R8 and R9 set the stage bias, while C11 is the emitter bypass cap. Choke RFC4 provides a DC path for the bias current, but acts as a high impedance to the input RF. RFC5 supplies the DC feed to Q2 and isolates the RF from the power bus. The gain of the final stage is about 10 dB, which results in an output power of 1 watt PEP. The CW output is slightly higher at about 1.5 watts RMS. C25 is the DC blocking cap for Q2, and passes the RF to a pi-network composed of C26, L1, and C27, which helps with harmonic attenuation. This completes the circuit description. I cannot claim credit for the basic design of the last two amplifier stages. These are patterned after ones in the *Solid State Handbook* from the ARRL.

Construction

Assembly of the exciter (see Figure 2) should be done a stage at a time, starting with the oscillator and progressing through to the amp Q1. It will be helpful to monitor your progress by the use of a SSB receiver, tuned to 28.322 MHz, as you assemble each stage. Remember that the oscillator module is generating a hefty 40 mW by itself and may give a significant signal to the receiver. Switch S1 can be mounted on the front of the mini-box which you house the transmitter in, along with a jack for connecting the microphone. I used a garden variety electret microphone which contains two wires: one black wire to ground, and a red wire connected to C17, also in series with a 10k resistor to +12 volts. Electrets contain an on-chip amplifier and must have a source of DC to power them. Alternately, you could supply a source of 100 mVp-p signal from an audio amp into C17. Some provision must be made to switch the +12 volt supply on and off to the transmitter. This could be a simple toggle switch on the front panel, or a PTT relay, activated by a button on the mike. Remember, you must turn off the transmitter in order to receive! No provisions have been made for a drive control in DSB mode, but a pot connected to the mike input could be used to set the maximum modulation level. With a little practice monitoring your own signal you will have no trouble finding a voice level which gives clear, undistorted audio that is less than 100% modulation.

In case of trouble, the following voltage checks should help you out. With a good quality scope you should read 0.6 Vp-p RF at pin 1 of the mixer, 0.6 Vp-p RF at the output of U3, 7 Vp-p RF at the collector of Q1, and 20 Vp-p RF at the collector of Q2. These measurements are made in CW mode. The mike amp should deliver 0.3 Vp-p of audio to pins 3,4 of the mixer with 100 mVp-p of audio input to the mike jack. You can operate with just the exciter by hooking the antenna directly to the output of the exciter PC board. For an additional boost, just run a short run of RG-174 coax between the exciter and the power amplifier board (see Figure 3) and hook up your antenna to the PA output.

This simple, low-cost transmitter can be put to a variety of uses, such as a backpacking rig, or even a 10m DSB transmitter for balloon flights. By utilizing a common frequency, this unit can create a breeding ground for experimenters, and keep you in touch with like-minded others.

I hope to start work on a companion receiver soon! 73

Parts List

R1,R2	150 ohm resistor
R3	330 ohm resistor
R4,R10	510 ohm resistor
R5	470 ohm resistor
R6	39 ohm resistor
R7	10 ohm resistor
R8	100 ohm resistor
R9	2 ohm, 1/2-watt carbon resistor
R11	180k carbon resistor
R12,R14,R15,R17,R18	10k resistor
R13	47k resistor
R16	20k resistor
R19,R20	1k resistor
R21	220 ohm resistors
C1,C6,C10,C12,C15,C25,C22	0.01 µF 100-volt ceramic cap
C2,C4,C8,C9,C11,C16	0.1 µF 50-volt monolithic cap
C3	120 pF 50-volt ceramic cap
C5,C7,C23	0.001 µF 50-volt ceramic cap
C13,C18,C24	10 µF 16-volt electronic cap
C14	not used
C17	1 µF 16-volt electrolytic cap
C19	0.012 µF 50-volt monolithic cap
C20	0.0039 µF 50-volt monolithic cap
C21	33 µF 16-volt electrolytic cap
C26,C27	100 pF 100-volt silver mica cap
C28	220 pF 100-volt ceramic cap
RFC1,RFC2,RFC3	25 turns #28 wire on a 100k 1/4-watt resistor
RFC4,RFC5	25 turns #28 on T37-6 core
T1	25T primary 8T secondary #28 on T37-6
T2	13T bifilar #28 wire on T37-6 core (see Figure 4)
L1	8T #24 wire on T37-6 core
Q1	2N3866 transistor
Q2	2SC2075 transistor (available from RF Parts)
Q3	2N3906 transistor
U1	78L05 +5-volt regulator
U2	SBL-1 mixer, Mini Circuits
U3	MAR-1 amp, Mini Circuits
U4	LM324 op amp
OSC	28.322 MHz clock oscillator, Digi-Key# CTX-128 (see Note 2).
FB	ferrite bead, Amidon Associates

Note 1: Etched and drilled PC boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The main transmitter board is available for $5 and the final amplifier for $3. You can order both boards for a combo price of $6. Add $1.50 per order for postage/handling.

Note 2: Oscillator modules on custom frequencies are available for $12.80 from Cal Crystal Labs, Inc., 1142 N. Gilbert, Anaheim CA 92801; (714) 991-1580. The part number is CCO-100A-xx.xxxMHz (replace the x's with your desired frequency).

Calibrated Signal Generator

An accurate RF source from 400 kHz to 33 MHz at the twist of a dial.

by John Pivnichny N2DCH

An accurately calibrated signal generator is a worthwhile instrument to have around the shack for equipment checkout. If you like to experiment with circuits or build your own equipment, you will often need a source of RF signals. This generator can produce a signal anywhere from 400 kHz to 33 MHz at the twist of its linearly calibrated dial. Output level is adjustable from zero to over 200 mV RMS.

Calibration

The most important part in the whole generator is the tuning capacitor. This is what permits a linearly calibrated dial. Fair Radio Sales sells a beautiful surplus worm-gear-driven 25-220 pF unit which was appropriately enough removed from a signal generator. Its rotor plates have the unusual shape shown in Figure 1. For this project the arc indicated is the only portion used. My preliminary measurements showed that linear frequency operation is possible with a 1.2:1 frequency ratio in exactly 30 turns of the worm gear drive shaft. I have no idea what the rest of this unusually shaped rotor was intended for.

I then determined the actual frequency deviation from a straight line dial by taking frequency counter readings to the nearest kHz at every turn of the capacitor drive shaft. See Figure 2 for the results. A positive error means the frequency is higher than expected at that turn of the shaft. The tuning range is 15 to 18 MHz.

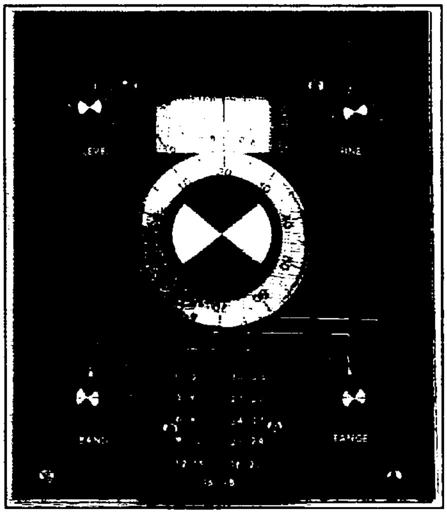


Photo A. Front panel of the signal generator.

All errors—capacitor plate shape, worm gear, circuit stray reactances, and the author's ability to position the shaft angle—are included. The net result is that the capacitor produces a straight line frequency tuning with less than 9 kHz maximum error from 15 to 18 MHz.

The oscillator circuit uses a CA3028 integrated circuit from RCA. Calibration is done by setting the low frequency end of the dial to exactly 15 MHz with the tuning slug in the variable inductor L1. Then tune the dial to the top and bring the frequency to exactly 18 MHz with the variable capacitor, then go back to the bottom and re-set to 15 MHz with the inductor, etc..

Although there is interaction between the two settings, this procedure of using the inductor at the low end and the capacitor at the high end will converge. Less adjustment will be required at each step, except the first one, until both ends of the dial line up at exactly 15 and 18 MHz. It is possible to cover this range in exactly 30 turns of the shaft and with less than 9 kHz of error at any point in the whole range.

Dial Construction

The main tuning knob covers 100 kHz per turn. A clear plastic skirt 2.5" in diameter with a paper dial divides this up into markings every 5 kHz. I used a 1.75" diameter knob and glued the skirt onto the back of the knob with plastic pipe cement, then fastened the paper dial to the back of the skirt with Scotch tape.

A large plastic pulley 4.5" in diameter is used to hold the main dial, which has 31 evenly spaced graduations marked in tenths from 0 to 3.0. A full-size pattern of both this dial and the knob skirt dial is reproduced in Figure 3. These can be repro-

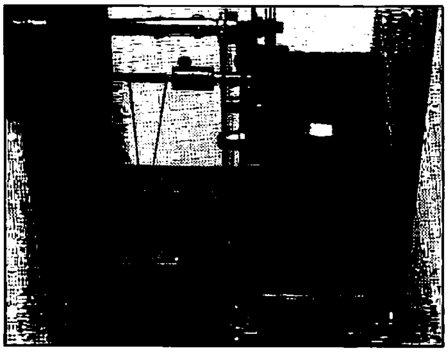


Photo B. Dial cord arrangement, right side.

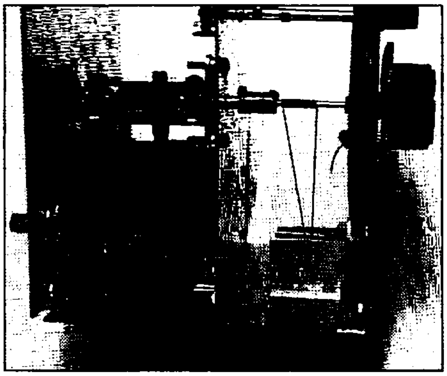


Photo C. Dial drive as viewed from the left side.

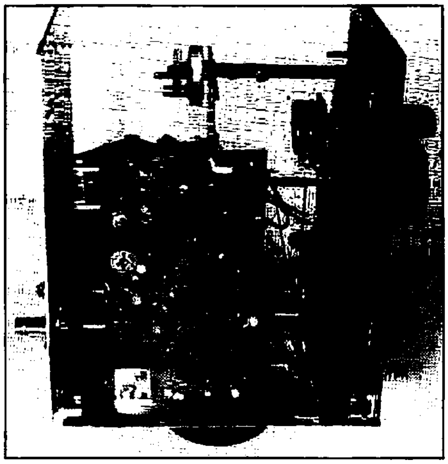


Photo D. Inside view of the generator showing the main circuit in place.

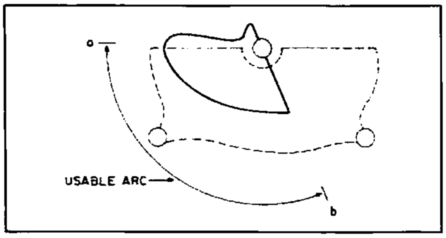


Figure 1. Capacitor rotor shape.

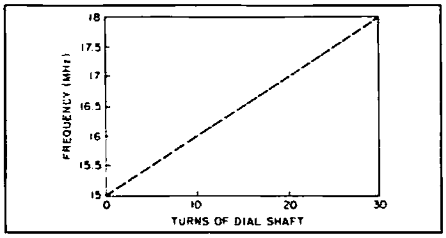


Figure 2. Capacitor error.

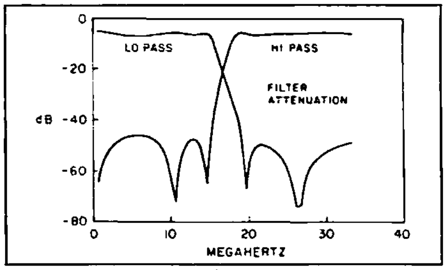
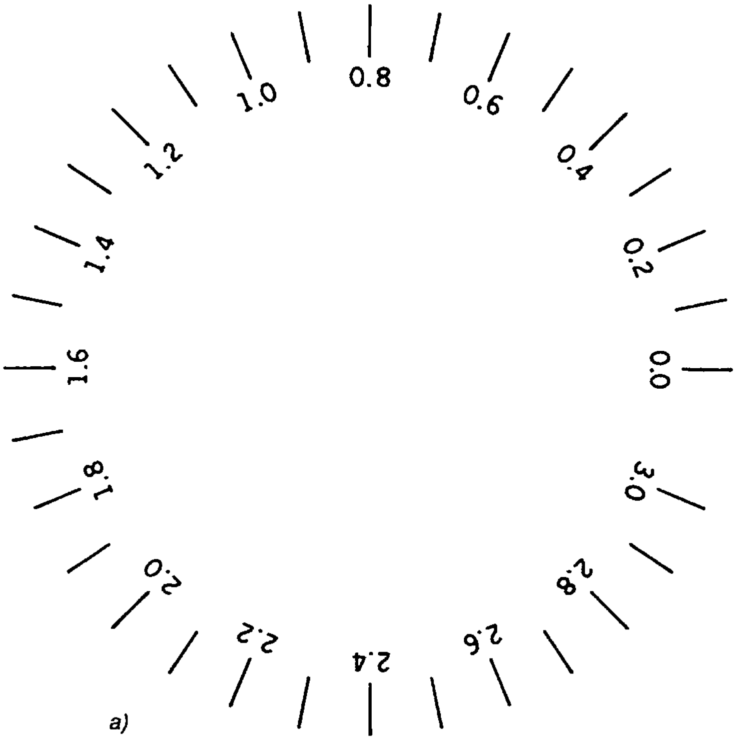
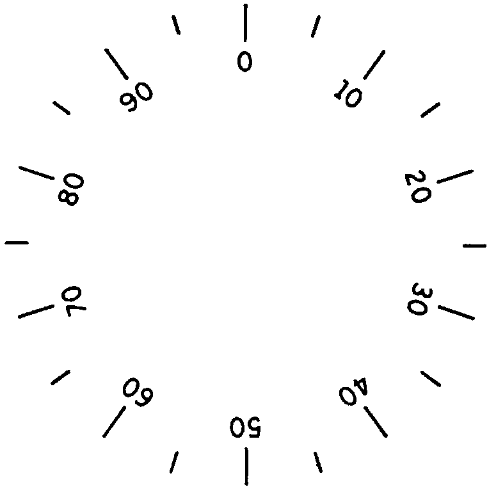


Figure 5. Filter responses.



a)



b)

Figure 3a and 3b. Frequency dials, full size.

duced on a copy machine for use in building the signal generator. A frequency in the 15 to 18 MHz range is set by adding the main dial reading in MHz to 15, then reading the kHz from the knob skirt.

The main dial pulley is driven by a string arrangement as shown in Figure 4, with 30 turns around a 1/8" shaft wound from back to front as the tuning range is covered. Two 1"-diameter plastic pulleys feed the cord up and across two small brass guide pulleys and onto the large dial.

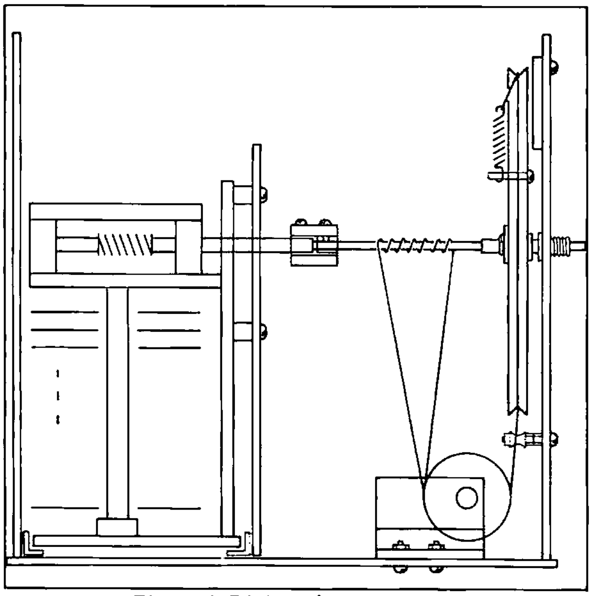


Figure 4. Dial cord arrangement.

Frequency Mixing

The remainder of the high frequencies from 0.4 to 33 MHz is covered by mixing this 15 to 18 MHz base range with a switched fixed frequency oscillator in 10 additional bands of 3 MHz each. Each fixed frequency provides two bands, one above and one below the base range. For example, mixing the base range with a 6 MHz oscillator signal produces 9 to 12 and 21 to 24 MHz ranges. The upper or lower band is selected by switching in either a high-pass or low-pass filter, described later in this article. Only five fixed frequencies are required: 3, 6, 9, 12, and 15 MHz.

An MPF102 FET transistor circuit is used with five separate slug-tuned tank circuits to generate the fixed frequencies.

The five tank circuits can be built and checked with your dipper before soldering into place on a piece of single-sided circuit board mounted behind the six-position band switch.

Final setting is done after the cover is in place by adjusting the slugs through holes drilled in the left side of the cover.

See the parts list for suggested tank circuit information. However, you can use practically any coil forms in your junk box by winding a trial set of turns for a particular capacitor, checking the frequency on your dipper, and then removing turns or rewinding with additional turns to get to the proper frequency.

In addition to the desired sum and difference frequencies just described, other unwanted signals may be produced in a mixer circuit. My use of the MC1496 doubly balanced mixer greatly eliminates both fundamentals, the fixed frequency and the 15-18 MHz adjustable one. Even harmonics of both are also balanced out. In addition, signal input levels to the mixer are properly controlled to keep them below 60 mV in order to minimize third order mixing products.

The mixer is unbalanced by shifting the DC bias of one carrier input when the 15-18 MHz band is selected in order to let that signal come through without mixing. Power to the fixed oscillator circuit is turned off, and the filters are bypassed when selecting this base range.

Filters

After mixing, either the sum or difference frequency is selected by filter FL1 or FL2. These are each five-pole elliptic designs with 40 dB attenuation of the unwanted signal. The designs are not critical and allow for normal component tolerances. The filter responses are shown in Figure 5 and the corresponding schematics in Figure 6.

Standard value ceramic capacitors are used. Inductors are wound on T37-2 (red) powdered iron torroids with #26 enamel wire for the low pass and #30 for the high pass. No alignment is necessary.

Amplifier and Level Control

After mixing and passing through the filters, the signal needs to be boosted in amplitude for some applications. The MC1350 circuit provides up to 40 dB of gain when used in a push-pull arrange-

Parts Availability Table

C1	25-220 pF variable, Fair Radio Sales #C9/SG-15
C2	8-20 pF trimmer, Fair Radio Sales #074-050J-2
C3	5-12 pF trimmer
C4	16 pF
C5	300 pF
C6,C10,C13,C15,C16,C17,C19,C20, C21,C22,C23,C24	0.01 µF
C7,C8,C11	47 pF
C9	470 pF
C12	68 pF
C14	0.047 µF
C18	0.22 µF
C25	0.022 µF
R1	2k resistor
R2	3.9k
R3	4.7k
R4,R5	15k
R6	1.8k
R7	2.4k
R8,R13,R15,R17,R19,R20,R25,R32,R35	1k
R9	100k
R10,R36	270 ohm
R11,R12	470 ohm
R14,R18,R26,R37	510 ohm
R16	820 ohm
R21,R29,R34	10k
R23	300 ohm
R24	100 ohm
R27	1.5k
R28	680 ohm
R30	1k potentiometer
R31	1.2k
R33	51k
R37	150 ohm
L1	5T #22 wire on 1/4" slug tuned form
T1,T2	trifilar 10T #26 wire on Fair Rite #2643002401 torroid, Amidon FT37-43 also usable
U1	Harris/RCA CA3028 RF amplifier/oscillator, Jameco, also available as ECG724
U2	Motorola MC1496 balanced mixer, Jameco
U3	Motorola MC1350 if amplifier, Jameco, also available as NTE746 or ECG746
MPF102	Radio Shack 276-2062
2N2222	Radio Shack 276-1617
S1	2-pole, 6-position rotary switch, Radio Shack
S2	4-pole, 3-position rotary switch, Radio Shack
knobs	Caltronics Filter inductor (all wound on Amidon T37-2 torroid cores):
3 uH	27T #26
4.6 uH	34T #26
5 uH	36T #30
7.6 uH	44T #30 Fixed frequency tank circuits:
3 MHz	70T #33 on 9/32" form with 100 pF capacitor
6 MHz	27T #30 on 9/32" form with 100 pF
9 MHz	21T #26 on 1/4" form with 100 pF
12 MHz	18T #26 on 7/32" form with 100pF
15 MHz	11T #26 on 7/32" form with 100 pF

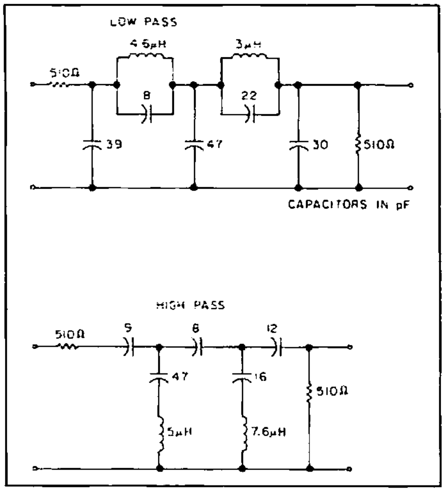


Figure 6. Filter schematics.

ment as shown. A broadband transformer using a ferrite torroid from Fair-Rite Products, terminated in a 1k ohm resistor, does a nice job over the entire high frequency spectrum.

Level control comes from adjusting the AGC input voltage between 5 and 9 volts with a 1k ohm front panel potentiometer. Maximum gain occurs at 5 volts with an over-60-dB drop in signal at 9 volts. A cathode follower circuit then isolates the amplifier and drives the output BNC jack with over 200 mV at a 270 ohm source impedance.

Power

I recommend a regulated 12-volt supply for this generator. I installed an RCA phono jack on the rear panel and use an external bench supply. There is ample room, however, inside the home-brew 6" x 7" x 6" box to accommodate a battery- or line-operated supply if you want to build one in.

Construction Details

The overall schematic is shown in Figure 7. Plastic pulleys are easily turned with an electric drill and file (see J. Pivnichny, "A Homebrew Tuning Dial," *Ham Radio*, December 1988, p.75). The small brass pulleys are made from 1/4" brass spacers, also using the electric drill and file for turning. I included a small APC trimmer capacitor as a fine-tuning control. This is ideal for tuning through the skirts of crystal filters. One of the nice things about home-brew gear is that you can include features like this if you do crystal filter experimenting.

The 7" x 6" front panel has a 1" x 2" window cut out and backed with a 1-1/2" x 3" x 1/8" sheet of clear plastic. A vertical line is scribed on the plastic and filled with black magic marker to serve as the cursor. White dry transfer letters are used on a dark gray paint. Additional lines are put on using a drawing pen and white drawing ink. A final lacquer spray before mounting the controls protects the lettering.

All components except the panel controls and tank circuits are mounted on the foil side of a 3" x 5" piece of single-sided epoxy glass circuit board. The foil serves as a ground plane. Component leads pass through counter-sunk holes and are interconnected on the back side. See the photographs for placement of the circuit boards inside the box.

Final Words

I've used the generator along with my sensitive RF voltmeter (see J. Pivnichny, "A Sensitive RF Voltmeter," *Ham Radio*, July 1989, p. 62) for lots of measurements around the shack. Most measurements can be made with the signal provided at the BNC jack. For very sensitive work, remember that unwanted signals (although 40 or more dB down) are still present so additional external filtering may be desirable.

Good luck with building your own laboratory-style signal generator.

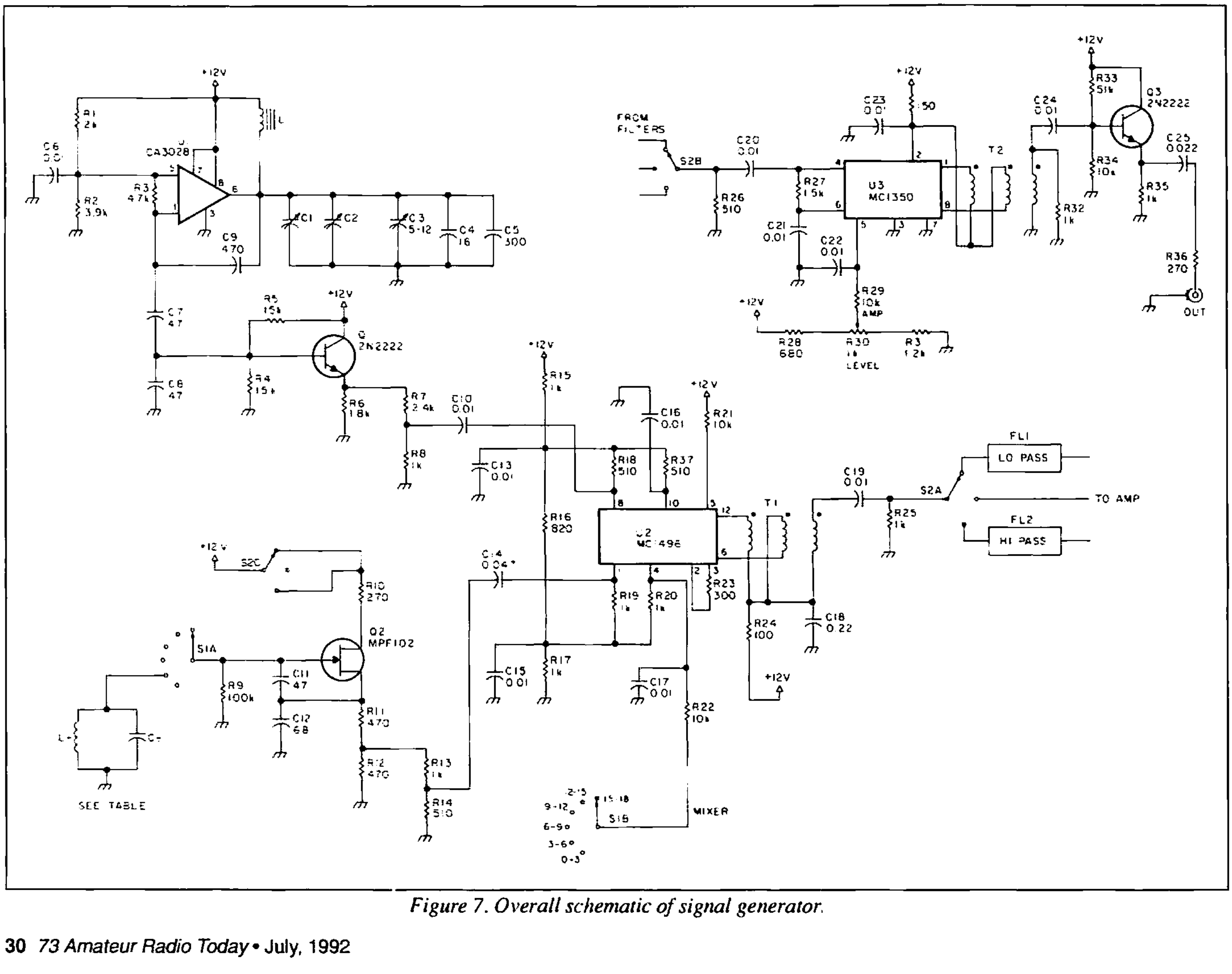


Figure 7. Overall schematic of signal generator.

A Receive Converter Adapter for 2 Meter Transceivers

Monitor 6 meters or 220 MHz with this unique circuit.

by J. Robert Witmer W3RW

Curious about 6 meter or 220 MHz activity in your area but not ready to spend the money for a dual-band or extra transceiver to find out? The receive converter adapter approach may be just the way to solve this problem.

OK, what's a receive converter adapter? A receive converter adapter is an interface device that provides a way to add receive coverage of an additional ham band by the use of an external converter, while still allowing normal operation of a 2 meter transceiver. This article describes how to build and use the receive converter adapter and offers some approaches to putting together converters to use with it.

Many of the latest model 2 meter FM transceivers have extended receive coverage and a large number of memory channels. With the converter adapter you can interface a converter covering an additional band such as 220 or 6 meters to the 2 meter transceiver without impacting normal 2 meter operation, and put some of those extra memory channels to use.

The only catch in this approach is that the frequency range you plan to use for the output of the receive converter (the IF)—say 142 MHz to 144 MHz—must be relatively free of on-the-air signals in your area. If it isn't, because of how the converter adapter works, you will receive both the normal 2 meter signals and the converted signals simultaneously—which, depending on your operation, may not be a disadvantage, either. Figure 1 shows how this works.

How it Works

A Wilkinson Hybrid ("Wilkinson Hybrids," *Ham Radio*, January 1982) forms the basis for the receive converter adapter design (see Figure 2 for the schematic). A similar technique is used to feed stacked beams for improved antenna gain. The Wilkinson Hybrid is shown by the shaded area in Figure 2. In receive operation the Hybrid acts as a combiner to couple two inputs to the receiver with minimal insertion loss, maintain isolation between the inputs and provide impedance matching. During receive the converter adapter works essentially this way—it couples the output of the converter and the 2 meter antenna to the 2 meter rig.

During transmit, without the circuitry outside the shaded area, the Wilkinson Hybrid would act as a splitter dividing the transmitter output approximately equally between the two ports. This is clearly not desirable—the effective output power to the antenna would be cut in half and the receive converter would probably be blown away on the first transmission. In the converter adapter, diodes D1 and D2 short during transmit, which protects the output of the converter and electrically disconnects the quarter-wave section of coax $\pi 2$ from the 2 meter connection port of the adapter. This action prevents the Wilkinson Hybrid in the converter adapter from acting as a splitter.

To provide impedance matching for the transmitter, the additional coax section $\pi 3$ is inserted, otherwise the transmitter would see a greater than 2:1 VSWR. Sections $\pi 1$ and $\pi 3$ are shown separately in the figure for explanation purposes but in the actual adapter they are combined into one continuous length of coax resulting in a half-wavelength section. The addition of section $\pi 3$ does have a disadvantage on receive because it interferes with the normal operation of the Wilkinson as a combiner by presenting a mismatch to the output of the converter. (Nothing is ever as easy as it first seems!) This causes an effective loss in the coupled output of the converter of approximately 3 dB. In actual operation this is not usually noticeable because of the gain of most converters and the strength of typical FM signals. The low-pass filter consisting of C1, C2 and L1 suppresses the low level harmonics generated by D1 and D2 and provides additional rejection of out-of-band interference.

The Receive Converter Adapter can be used with a scanner as well (see Figure 3 for the scanner configuration). During receive, the signal from the antenna is split approximately in half to the scanner and 2 meter rig ports. The electrical disconnection of coax section $\pi 2$, described above during transmit, permits the 2-meter rig to be electrically connected directly to the antenna with minimum interaction and transmit loss due to $\pi 2$. The only other difference is that the lowpass filter consisting of C1, C2 and L1 is moved to the antenna port. The low-pass filter will have an effect on scanner performance as you go higher in frequency from 2 meters.

Using the Converter Adapter

I use the converter adapter to add 6 meter receive capability to my Kenwood 4100A dual-band transceiver. I use the 142 MHz to 144 MHz section of the band as my receive IF. Where I live, approximately 15 miles north of Philadelphia, there is very little strong FM signal activity in the 142 to 144 frequency segment. Check the band for a similar "quiet" segment in your area before selecting an IF band. I've also used the converter adapter approach to monitor 220 MHz activity using the 146 to 148 MHz range as an IF but I've encountered some interference from in-band 2 meter signals. Converters for use with the converter adapter can be constructed using basic building block circuit elements. Figures 4, 5 and 6 show typical configurations that can be used for each band. A brief discussion of each follows.

Six meter converter adapter operation: The 6 meter converter and hook-up are shown in Figure 4. The preamplifier section of my converter consists of the RF amplifier from an RCA 1000 commercial rig, but any 6 meter preamp such as those available from Hamtronics or shown in the *ARRL Handbook* ("Dual-Gate MOSFET Preamplifiers for 28, 50, 144, and 220 MHz", the *1990 ARRL Handbook*, Chapter 31, pages 31-1 to 31-2) should also work well. The local oscillator is a Butler type (R. Campbell, "A Clean, Low-Cost Microwave Local Oscillator," *QST*, July 1989, pages 15-21.) with a 90 MHz 5th overtone crystal (see Figures 7, 8a and 8b).The capability of the circuit to "free" oscillate with a 47k resistor in place of the crystal and L2 can be used to get the oscillator L1 and C1 components on frequency to insure crystal oscillation. Use a frequency counter or FM broadcast receiver to check the operating frequency. L1 is non-critical—the best approach is to make a coil like that specified, try it, and if it doesn't give you the desired frequency oscillation range with C1, adjust its size. If you have an approximately similar variable slug-tuned coil, try that. The same approach was used for L2, the crystal frequency trimming inductor. Once the oscillator free-runs in the right range remove the 47k resistor and install the crystal and L2. Monitor the current to the oscillator and adjust C1 for a peak in current drain, indicating that oscillation is occurring. Adjust L2 for on-frequency operation and re-peak C1 for maximum

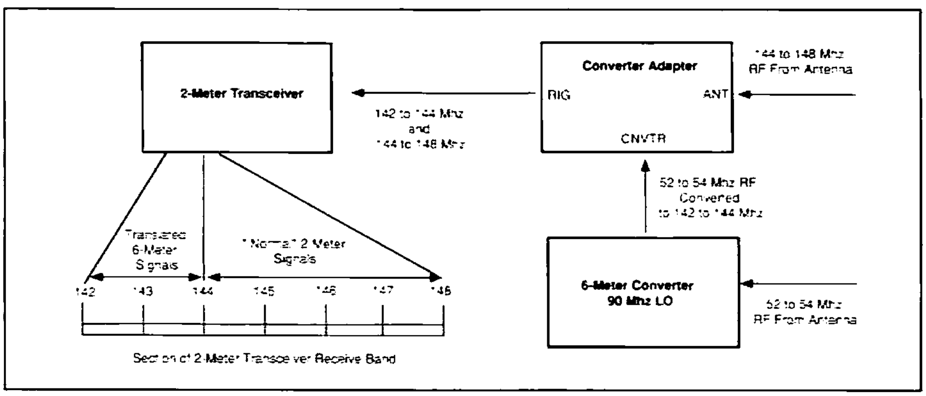


Figure 1. Block diagram of the Receive Converter Adapter.

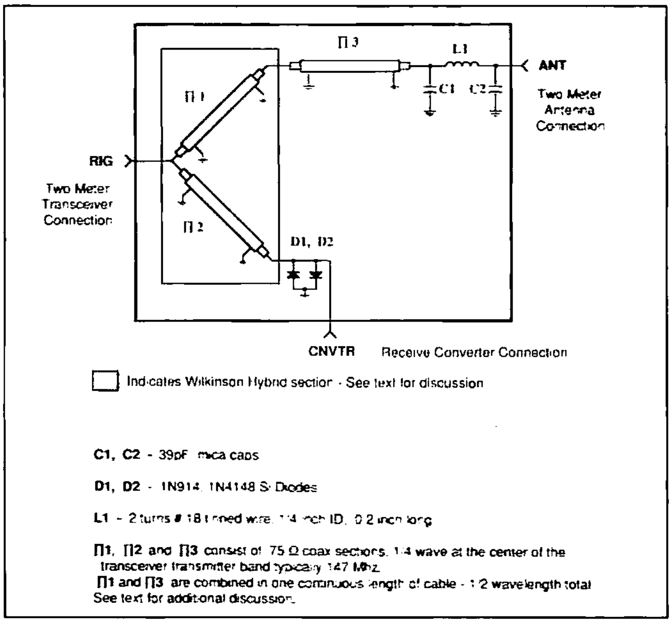


Figure 2. Schematic diagram of the Receive Converter Adapter as used with a 2 meter transceiver.

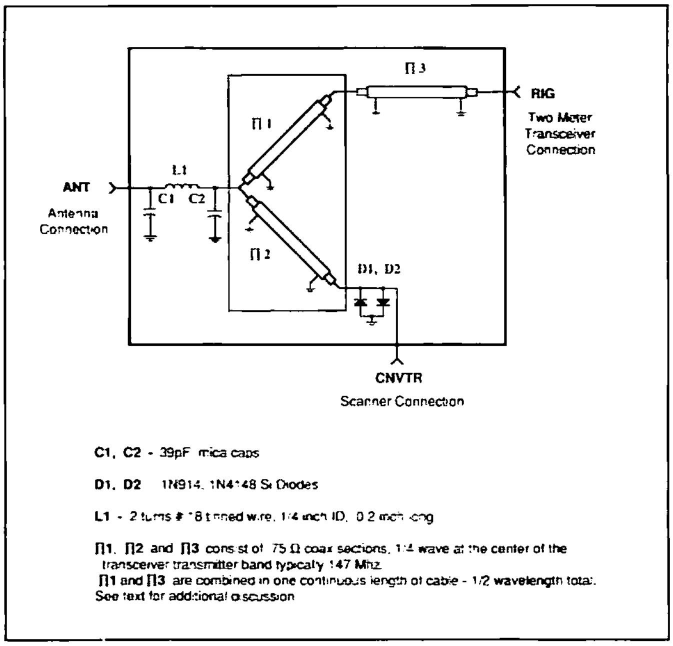


Figure 3. Using the Receive Converter Adapter with a scanner.

current—there is some interaction between these adjustments. Between the output of the oscillator (Q1 and Q2) and the MMIC (U2) is a low-pass filter consisting of L4, C16 and C17.

The mixer is a Mini-Circuits Labs SBL-1 DBM or equivalent. With the 90 MHz LO, 6 meter signals from 52 to 54 MHz are translated to 142 MHz to 144 MHz, which provides for ease of readout.

220 MHz converter adapter operation: Two 220 MHz converter configurations are shown in Figures 5 and 6. The converter in Figure 5 translates 223-225 MHz to 146-148 MHz which results in some interference between on-the-air 2 meter signals and the translated 220 signals, an example to possibly avoid depending on the activity in your area.

I've also used a 220 converter similar to the 6 meter converter just described (see Figure 6) except it used an 80 MHz LO. With an 80 MHz LO, signals from 223 to 225 MHz are translated to 143 MHz to 145 MHz, which again provides for simplified frequency translation.

Construction

My converter adapter was constructed in a small aluminum chassis using a mixture of UHF and BNC connectors to match the cables I had. RG-59/U 75 ohm coax was used. Be careful that diodes D1 and D2 are soldered directly across the converter connector (CNVTR) with minimum lead length. If the diodes are accidentally placed across either of the other connectors, a high SWR will be presented to your rig on transmit. Installation of the diodes is best done after the coax sections are soldered to minimize excess heating. An ohmmeter check of the coax sections after installation is a good idea to make sure no inadvertent shorts were created during soldering. A two-lug terminal strip was soldered to the base of the antenna port connector SO-239 and supports the input (coax) end of L1 and C1. The output side of L1 connects directly to the center conductor of the antenna port connector to which C2 is soldered.

Trim the coax to approximately the length needed—remember to include the velocity factor of the coax. For RG-59/U this is usually 0.66, which means a quarter-wavelength of cable at 147 MHz should be approximately [(246/147) x 0.66] feet long, which comes to approximately 1.1 feet, using the formulas from Chapter 16 of the *ARRL Handbook*. The half-wave section is simply twice this long. (If you are going to use the grid dip oscillator (GDO) technique for fine tuning the sections, cut them a little long to begin with.)

Oscillator Construction: The local oscillators for the 6 meter and 220 MHz converters were constructed using a technique I've used for several years for RF circuits. Using a 2-1/4" by 3-3/4" piece of double-sided G-10 circuit board material as the base, I glued small pieces of single-sided board material, cut to the size required for the particular pads, to the main board. Feedthrough bypass capacitors are used where possible for bypass requirements. With this approach, the DC power distribution is done on the opposite side of the circuit board from the RF components. Grounding is accomplished by soldering directly to the ground plane—keeping the RF circuit ground leads as short as possible. If a change is required you can pry the desired pad loose and glue it in the new location. Figures 8A and 8B show the approximate part layouts of my 90 MHz local oscillator. Try to use small components when possible; it will simplify construction and minimize problems associated with layout. L1 and L2 must be mounted perpendicular to each other. L1 is mounted horizon-

Continued on page 59

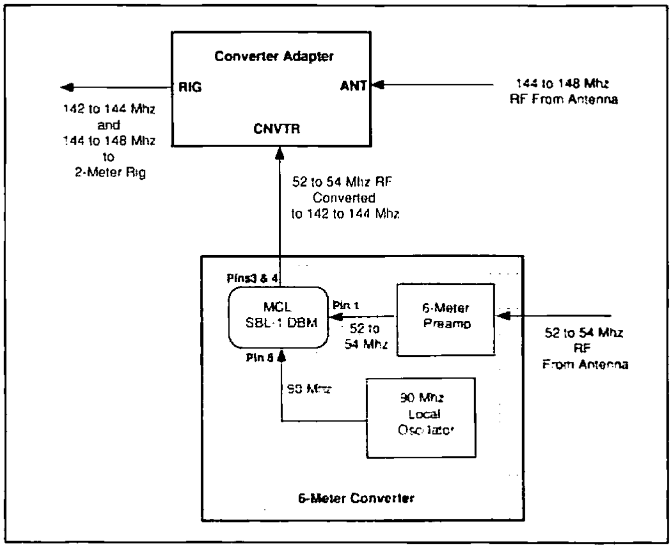


Figure 4. Six meter converter for the Converter Adapter.

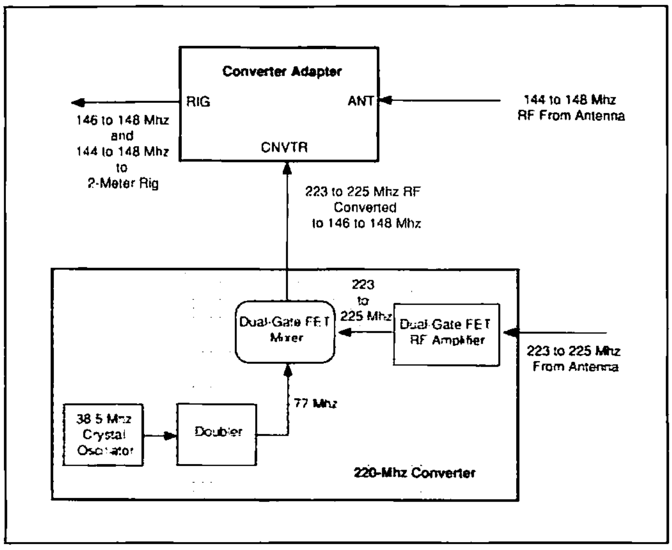


Figure 5. Converter circuit for 220 MHz operation.

73 Review

by Michael Bryce WB8VGE

Number 9 on your Feedbvack card

MFJ Enterprises, Inc.
Box 494
Mississippi State MS 39762
(601) 323-5869; Orders: (800) 647-1800;
Fax: (601) 323-6551
Price: Model MFJ-9020 alone, $179.95;
Entire Integrated CW Station
(MFJ-9020 plus portable tuner,
portable power pack and
20 meter antenna), $329.80.

The MFJ-9020 20 Meter CW Transceiver and Integrated CW Station

A versatile and portable QRP combo.

Mention MFJ and visions of antenna tuners and ham accessories pop into your head. Until recently, QRP rigs weren't in the line-up. The MFJ-9020 will alter your thinking from now on.

The MFJ-9020 is a 20 meter QRP (low-power) transceiver designed by Rick Littlefield K1BQT. It covers 14.000 to 14.075 MHz of the 20 meter CW band. The MFJ-9020 is a CW-only transceiver; it will not transmit SSB nor receive SSB.

First Impressions

After opening the box, what really impressed me was the "feel" of the rig. It's constructed of 1/16-inch aluminum throughout. The speaker is top-mounted. There are but three controls on the front panel: volume, VFO tuning and RIT. Two LEDs give the operator visual verification of power on and off as well as transmit.

The back panel sports the usual power connections, which fit a 5.5mm o.d. coaxial plug. The center pin is positive. For keying the radio, you have two choices. First, you may plug in a straight key, output from a keyer or even an old bug in the key jack. The key jack requires a 3.5mm mono plug. Or, you may install the optional keyer and then use the keyer's jack, which requires a 3.5mm stereo plug.

There's an additional switch for the optional CW audio filter. In the review unit, both the keyer and the audio filter are in place. Both the switch to select the audio filter and the keyer speed are mounted on the back panel.

A real surprise for a QRP transceiver is finding an SO-239 antenna connector instead of the common RCA jack many QRP builders use for RF connections.

Of course I had to open the case for a look inside. I'm impressed! The entire transceiver is built on one double-sided board with plated-through holes. There are but three wires in the entire radio: two wires for the speaker and one from the PC board to the antenna connector. Everything else is mounted on the PC board. And I mean *everything* is mounted on the PC board, including all the pots, LEDs and all the input/output jacks. Not only does this make for a very reliable unit, but it also reduces labor cost during construction. The PA transistor, an MRF 476, is bolted to the side of the chassis. The MFJ-9020 easily passed the number five crane test. That's a drop of three feet onto a solid surface.

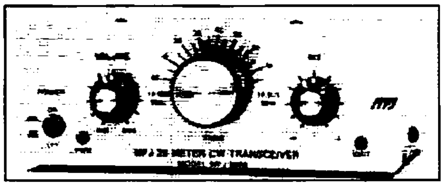


Photo A. The MFJ-9020 20 meter CW transceiver.

Photo B. The MFJ integrated CW station includes the transceiver, a portable antenna tuner, a portable power pack and a 20 meter folded dipole.

The PC board is well labeled with all the adjustment pots clearly marked as to what they do. All the ICs are in sockets for easy replacement if and when replacement is needed. If you've ever worked on a double-sided board with plated holes, you'll instantly know the advantages of IC sockets. There are no "Do Not Touch" areas on the board. The circuit is simple and well thought out.

The Manual

A very detailed manual comes with the MFJ-9020. They even include all the Radio Shack stock numbers for the required plugs used for power and keyer. By the way, don't use molded adapters as they may damage the input/output sockets on the PC board.

Both a block diagram and full schematic have been included. This is a real nice touch for repairing the MFJ-9020 should the need arrive. If nothing else, it's nice to read how it works and why.

There are many tips for setting up the MFJ-9020 and getting it on the air. Included in the manual are several examples of simple 20 meter antennas. Several pages of field alignment procedures, as well as some general troubleshooting, may also be found in the manual.

The Insides

The MFJ-9020 is sensitive. A side-by-side comparison between my Argosy II and the MFJ-9020 showed very little difference between the two. If I could hear a station on the Argosy II, I could hear it on the MFJ-9020. The receiver is a superhet—NOT A DIRECT CONVERSION RECEIVER! You get single-signal reception with the MFJ-9020, thanks in part to the 8-pole crystal filter. The crystal filter is about 750 Hz at -6 dB. With the optional audio CW filter, you have some very powerful QRM-fighting tools.

Receiver signals are preselected by a 4-pole bandpass filter before the signal is routed to the NE602 receiver mixer. A 78L05 keeps the VCC regulated at 5 volts to ensure a voltage-stable VFO. A varactor RIT circuit provides VFO shift on receive only. A MC1350 IF amplifier is coupled to a second NE602 used as a product detector. This comprises the IF stage. Audio from the product detector goes to an LM386. The LM386 operates at full-loop gain and the volume level is set by an adjustable attenuator. Receiver AGC is provided by the LM386. AGC delay seems to be just about right for CW use.

On the transmit side, a third NE602 mixer

couples signal from the VFO with its 10 MHz transmit oscillator to produce 14 MHz CW. After two stages of amplifiers/buffers, the resulting signal is applied to the PA transistor. The MRF 476 produces 5 watts at 13.8 volts, consuming 1.2 amps of current.

Keying is semi-QSK with an antenna relay. There is an automatic 700 Hz transmit offset, just like the big rigs. During transmit, a sidetone is injected into the audio line.

Performance

Enough of this techno talk. How well does the MFJ-9020 work? In a word, great!

With only three controls to worry about, putting the MFJ-9020 on the air is about as simple as you can make it. You'll need a power supply running 13.8 volts at one amp or better. Any power source of one amp or so at 13.8 volts will work. A battery will work fine, but we'll talk more about battery operation later.

There is no reverse polarity protection built into the MFJ-9020. If you hook it up backwards, you'll be sending it back to the factory. Although the pin-out of the coaxial plug is shown in the manual, it's not silk-screened on the back of the radio. I can see in the heat of a contest someone hooking the MFJ-9020 up backwards. In the next run, MFJ will add a zener diode and fuse for full over-voltage and polarity protection. A new silk-screen will be cut for the back panel showing the pin out for the power jack.

With a 13.8 volt supply into a 50 ohm dummy load, the MFJ-9020 produces 5 watts right on the money. Current from the supply was 1.02 amps. Running the transceiver from a fully-charged battery (12.6 volts) produced 2.7 watts. As you can see, operation from a battery will produce a significant drop in RF output power. Keep this in mind for Field Day. However, at the 13.8-volt supply, the MFJ-9020 barely falls under the power level of the QRP ARCI. It's a QRO QRP rig! You may reduce power levels down to under a watt by adjusting the VFO trimpot. You can reduce the power right down to zero output if you wish.

I operate by the hunt-and-pounce method. Listening for CQs, I call the other stations. The tuning is very smooth and I was surprised to find how well the VFO tracked from one end of the dial to the other. It's not an IC-781, but dial calibration is a hundred times better than any HW-8 I've ever seen. I simply center the desired signal in the bandpass of the receiver and call. I use the RIT feature to fine-tune the signal into the bandpass when I turn on the audio filter. The RIT is very smooth from one end of its range to the other. You have about 1.5 kHz worth of RIT at your control. But, there is one drawback with the RIT: You can't shut it off. It would be nice to have a way to shut the RIT off or a center detent pot to allow you to center the RIT control. I talked with Rick Littlefield K1BQT about this, and he told me that MFJ will put in a center detent RIT control as soon as they can source the part.

The semi-QSK keying works without flaw. The antenna relay is a bit loud, but won't break any windows. The sidetone is a very pleasant sine wave instead of the usual QRP square wave noise makers.

I used both the internal Curtis keyer and my old Ten-Tec KR5 keyer. The internal keyer is nice, but if I had to choose between the filter and the keyer, the keyer would have to go in favor of the filter.

I found that the receiver's audio level was low. Although the LM386 is rated at only 600 mW, the MFJ-9020 produces barely enough audio to fill a very tiny, very quiet room. The receiver generates very little internal noise, so it sounded as though the rig was dead when I first powered it up. Even with headphones, the audio gain control must be run fully into the stops. Since you can't adjust the sidetone level, I had to turn the volume control down when transmitting to prevent the sidetone from killing my ears. *[Ed. Note: All current production units have been changed to greatly improve the audio output as described below.]*

This time Rick Littlefield came through with a suggestion and a fix. Low audio is due to gain reduction caused by lowering the output of the LM317 from 12 to 10.5 volts to accommodate battery operation. Rick says he's working on a modification to run the LM386 from an unregulated Vcc. MFJ will include the modification on the next production run and they will also supply information to those who already purchased the MFJ-9020. As a fix, I simply adjusted the regulator up to 12 volts. It seems that if I set it higher, the sidetone would begin to distort. That extra several volts made a marked improvement in audio output.

With 5 watts, I felt like king of the hill. If I could hear 'em I could work 'em. I worked many stateside contacts, as well as a dozen or so DX stations.

The keying is very good and there are no signs of clicks, chirps or buzzes on the signal. The keying sounds "big rig" instead of the sometimes classic "QRP whoop de woop."

The Complete Portable Station

There are three more accessories that make the 9020 a fully portable setup.

The 4114 power supply/charger, the 971 antenna tuner and a 20 meter folded dipole is available.

I used the model 4114 portable rechargeable power pack during this review. This is a self-contained power system for the MFJ-9020. A large wall transformer supplies AC to the 4114. inside a simple 7812 regulator circuit provides 13.8 volts at 1.2 amps. An LM317 is configured as a constant current source set at 100 mA for charging 12 D-size NiCd batteries. As with everything else in life, batteries are not included.

I'm not much of a D-size NiCd fan. Most of the 1200 mA D-size NiCds are nothing more than C cells on steroids. The C cells are rated at 1200 mA also. If you wanted to spend the extra money, then the high capacity NiCds would be a better way to go. Personally, I would swap out the NiCds in favor of two 6-volt 4 amp/hour gel/cells. They would easily fit inside the 4114s case. A second thought would be to use two 7.2 volt NiCd racing batteries. These would give you 1.2 amp/hours at 14.4 volts. The 4114 power pack is attractively styled to match the MFJ-9020. Since the 4114 is fused internally, shorting the output means a trip inside. It would have been nice to see a panel-mounted fuse holder instead.

The wall transformer plugs into the back of the 4114 using a header. Since the cord is very stiff, I'm concerned that it may eventually mess up the header's pins after repeated plugging and unplugging.

You can't recharge the batteries while you operate the radio. Pressing the charge switch does light up the LED, but no charging will be performed. You could easily get confused unless you unplug the transformer from the supply.

This way, the LEDs are dark, telling you you're on battery power.

The Portable Tuner

The 971 portable antenna tuner is a mobile tuner that has been updated to include balanced line and random wire antennas. Most importantly, the cross-needle SWR/power meter has QRP sensitivity. The meters will display 6 watts forward and 0.2 watts reverse. No "zero" or "sensitivity" adjustment is required with cross-needle SWR displays. The meter may be illuminated if desired.

There are three different power ranges. On the high end, 300 watts forward, 60 watts reflected; middle range, 30 watts forward and 6 watts reflected; QRP range, from 6 watts forward to 1.2 watts reflected. You have a choice of any two at a time. You can switch out one range from a rear-mounted switch. Normally, these are the 300-watt and 30-watt positions. By changing two jumpers on the main circuit board in the 971, you can select whether you want the 300-watt scale or the 6-watt scale. From the factory, the normal setting is 300 watts. I think this is rather odd, seeing the tuner is a match for the 9020.

The tuner works. There's nothing fancy inside but all of the components are heavy-duty. I was able to tune out the reactance of my triband beam quite easily with the 971.

Using the MFJ 20 meter folded dipole with the tuner was very easy. In fact, the folded dipole came out with a rather low SWR to begin with. I do wish the 971 tuner had a bypass position to remove the tuner from the line.

Since the 4114 power supply and the 971 tuner are both styled to match the MFJ-9020, the trio is an attractive QRP setup.

If you're one to go in the woods to operate, you can quickly set up a portable station with the MFJ QRP combo along with the MFJ folded dipole. If you're sitting at home, then the 9020 will be happy running off of your big rig's power supply.

Even though the MFJ-9020 is a simple radio using basic off-the-shelf parts, it is capable of worldwide communications thanks to its good basic design. It is so easy to operate that a beginner can make contacts as soon as the box is opened and power applied. The "have-done-it-all" ham will have a ball with this radio. The MFJ-9020 puts back into ham radio something long ago lost—FUN! The MFJ-9020 may be the best value going in a ready-to-play ham transceiver. ■

An Eight-Channel A-to-D Converter for Your Computer

Sample the analog world with this easy interface.

by Mike Gray N8KDD

Judging by the letters I received regarding the article "High Speed Data Acquisition" in the August 1991 issue of *73*, a lot of hams are using their personal computers to acquire climatalogical and seismic information, then share it via radio. Among the comments I received were requests for more input channels. I had already added a multiplexer to the old design, but quickly abandoned that idea because the thing kept getting more complicated. A few hours looking through the data books convinced me to try a whole new approach to the problem.

This latest interface connects to the printer port of any "clone" computer, desktop or portable. Only six wires connect the computer to the interface because the A-D chip transfers data to the computer in serial rather than parallel form.

The A-D converter has an 8-channel multiplexer that is controlled using only one wire from the computer. The data is transferred through another wire, which makes for a very simple circuit but complex software. I prefer it that way because software is a lot easier to modify than hardware, and it never wears out.

The interface needs a 9-volt battery to power the A-D chip and regulator. I had planned to use a line on the printer port to drive the interface, but the voltage available at the printer port varies among brands. The interface doesn't need to be powered up between samples, though, so I included a new surface-mount regulator with an integral switch that can be enabled using one line from the computer. The computer switches the interface on just before a sample, and turns it off after the data has been transferred. The battery lasts a lot longer that way. The regulator draws 1.8 mA even in the "sleep" mode, so I included a toggle switch on the front panel so you can shut the whole thing down. When the battery voltage drops to about 7 (replacement time), the LED will glow faintly in the sleep mode, and will light up brightly while the computer takes a sample. While the battery voltage is greater than 7, the LED will remain on, whether the A-D is awake or asleep. An alkaline battery will last over 20 hours if the computer samples once per second.

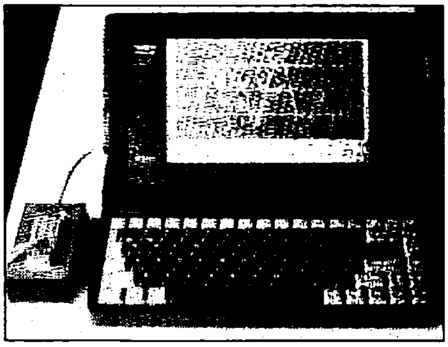


Photo A. The ADC in use.

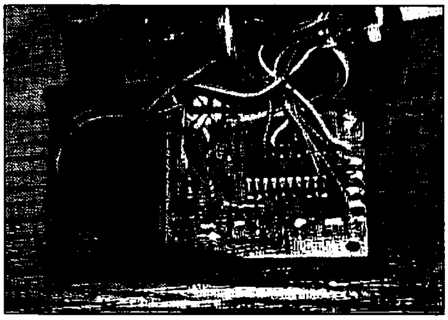


Photo B. Inside the box.

ADC Operation

The A-D converter (ADC) requires some complex programming to make it work, but that's a fair trade-off for the simple hardware. The operation of the chip is described in exhaustive detail in the *National Semiconductor Linear Databook, Volume 2*. You can write your own custom programs in your favorite language, but I've found that most folks can use my M-LOG.EXE program for their purposes. Software should be easy to use without having to refer to documentation. It should graph the data as it is collected, and store it on diskette. M-LOG.EXE has these features, and mouse support too. The program listed in the sidebar is the minimum required to make the ADC work. Everything else is frosting.

Before a conversion can be performed, the chip select (CS) line must be asserted low. Then the ADC needs a clock signal (CLK), and a bit stream on the data-in (DI) line to get set up for a sample. Once it receives the set-up stream, it performs an A-D conversion on the assigned channel.

The next eight clock signals cause the conversion result to appear on the data-out (DO) line, starting with the most significant bit (MSB).

The CLK line must be asserted high before starting a conversion on the next channel.

There are three addresses assigned to the printer port. The base address is pins 2-9 and these normally transmit data to the printer. The base address of LPT1 on most computers is 888 decimal, but some are 956. LPT2 is usually 632. M-LOG.EXE allows you to select between those three possibilities. The next address at the printer port is the base address plus 1, and it is assigned to pins 10,11,12,13 and 15. These five pins are used for input only. I like to use pin 11 and tie the others to ground.

The third address at the printer port is the base address plus two. It is assigned to pins 1,14,16 and 17; these are used for output only. I use pin 1 for the CLK line.

The ADC has a high input impedance which makes it susceptible to noise. That's the reason for the 1 meg shunt resistors on the input channels.

You can leave the resistor network out if you like, but you MUST make sure you provide appropriate filtering in order to protect the ADC and get accurate data. This article barely skims the surface of the science of

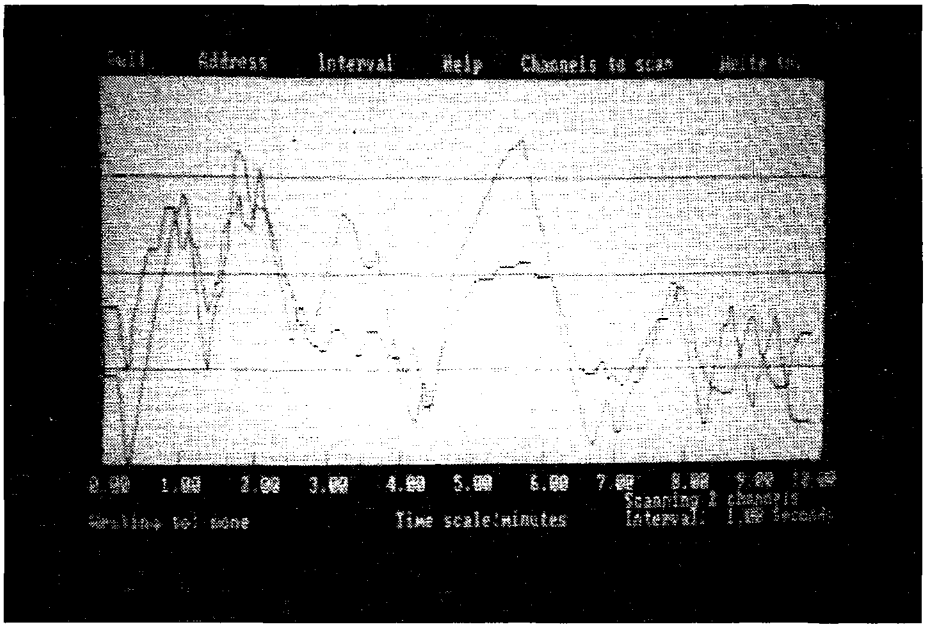


Photo C. M-LOG program running in CGA mode.

data acquisition. For more information on data aliasing, consult the *ARRL Handbook.*

Most laboratory transducers are scaled so that the output is 0 to 5 volts over their full sensing range. An input greater than 5 volts may damage the ADC, so be careful to scale all your transducers for this range. It's best to do the voltage dividing or amplifying near the transducer if you can.

Some transducers need external excitation. For instance, if you want to measure rotary position, you could use a 25k potentiometer with 5 volts applied to it. It would be wasteful to keep a power supply running, except during a measurement, so I included four terminal blocks which supply a regulated 5 volts when the computer wakes the ADC for a conversion. Using this 5-volt supply with resistive transducers will simplify things.

Construction

The hardware is reduced to a fairly simple form, so I chose to surface mount everything. You will have to bend the legs on the A-D chip so you can solder it to the board. The best way to do this is to push the chip onto progressively larger tubing until the legs are nearly horizontal.

Then finish the job by gently pushing it against a hard, slippery surface like a plastic-laminated counter top. If that seems too risky, bend the legs on an IC socket instead, and insert the A-D chip in the conventional manner.

Clean the circuit board by scrubbing it with a pencil eraser, to remove anything that might impede the flow of the solder. Trim one lead of a resistor and bend it so that the resistor will fit between the solder pads on the board. Tin one solder pad, then use the untrimmed lead as a "handle" and position the resistor on the solder pad. Touch a hot iron to the pad until the solder melts around the bent lead. With one end soldered tight, it will be easy to cut and bend the other lead to

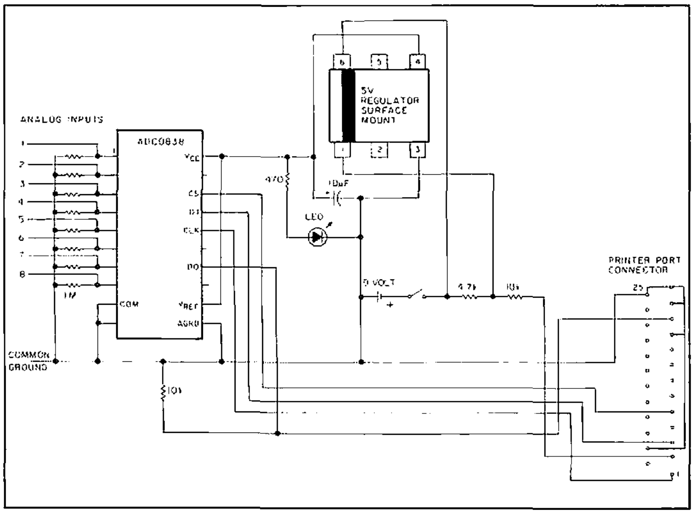


Figure 1. Schematic diagram of the A-to-D converter.

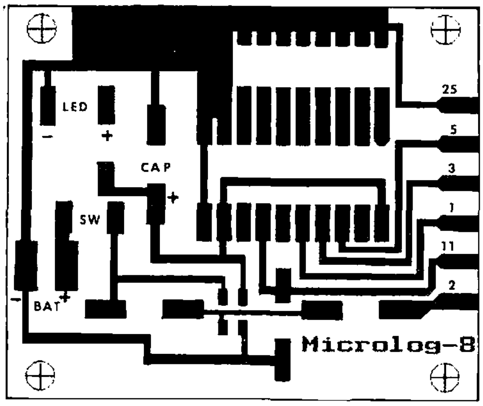


Figure 3. PC board foil pattern.

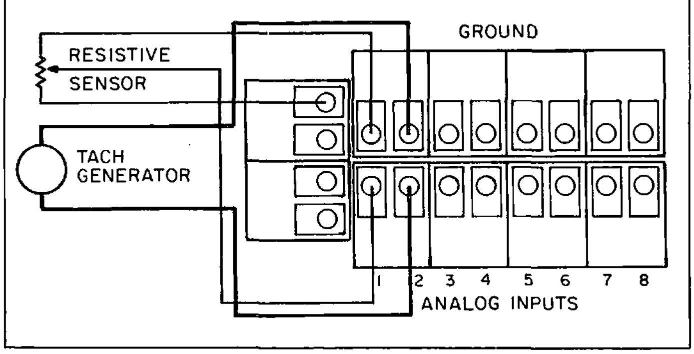


Figure 2. Typical connections for a variety of transducers.

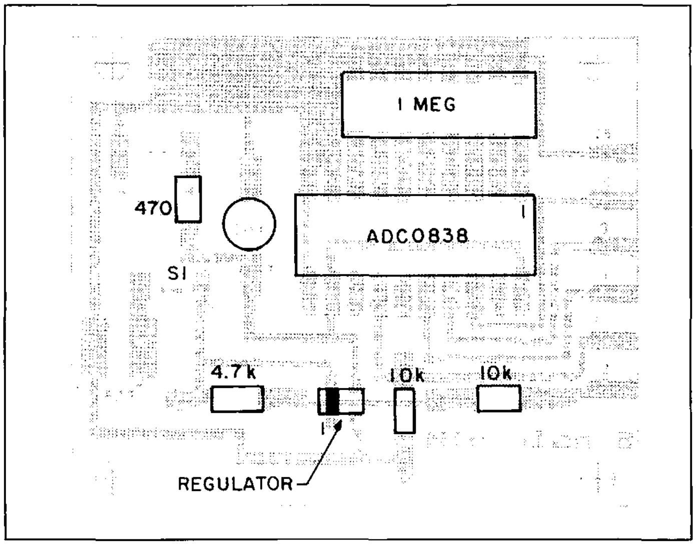


Figure 4. Parts placement. Note that all components mount on the foil side of the PC board.

The following program causes the A-D converter to perform eight sequential conversions and display the result. It's written in Turbo BASIC/Power BASIC source code, but it will run under the GW-BASIC interpreter if you replace the delay statements with FOR/NEXT loops, and add line numbers as shown in the second listing. These programs are available on the 73 BBS under the filenames ADC Turbo.BAS and ADCGW.BAS.

```
INITIALIZE:  'remarks follow the apostrophe
  screen 0                          'text mode 80 columns
  color 14,0                        'yellow on blue
  cls                               'clear the screen
  clear                             'clear all variables
  toggle%=2                         'initialize variables
  oddsign%=0

MINORLOOP:
  while not instat                  'keep going until a key is pressed
    out 888,1                       'regulator line high
  delay 1                           wait 1 second before next sample
    out 888,0                       'light up the regulator
    delay .054                      'wait 54 milliseconds to stabilize
  for ch%=0 to 7                    'scan 8 channels
    out 888,8                       'CS high pin 5
    out 888,0                       'CS low
    out 888,2                       'start bit is always high DI line
    out 890,0                       'clock high pin 1 of DB 25 printer
      for slow%=0 to 1:next slow%   'stretches clock pulse
    out 890,1                       'clock low
    out 888,2                       '8 single ended measurements selected
    out 890,0                       'clock high
      for slow%=0 to 1:next slow%   'stretches clock pulse
    out 890,1                       'clock low
    out 888,oddsign%                'part of the channel selection string
    swap oddsign%,toggle%           'toggles between high and low
    out 890,0                       'clock high
      for slow%=0 to 1:next slow%   'stretches clock pulse
    out 890,1                       'clock low
    out 888,select1%                'part of the channel selection string
    out 890,0                       'clock high
      for slow%=0 to 1:next slow%   'stretches clock pulse
    out 890,1                       'clock low
    out 888,select0%                'part of the channel selection string
    out 890,0                       'clock high
      for slow%=0 to 1:next slow%   'stretches clock pulse
  out 890,1                         'clock low
READBITS:
    for bit%=7 to 0 step -1         'MSB is first out
    out 890,0                       'clock high
      for slow%=0 to 1:next slow%   stretches clock pulse
    out 890,1                       'clock low
    ad%=inp(889)                    'port 889 pin 10  7-low135-high
    if ad%<120 then byte%=byte%+(2^bit%)
    next bit%
    if ch%=0  then  select1%=0 : select0%=0 : ch0volts=byte%/51
    if ch%=1  then  select1%=0 : select0%=2 : ch1volts=byte%/51
    if ch%=2  then  select1%=0 : select0%=2 : ch2volts=byte%/51
    if ch%=3  then  select1%=2 : select0%=0 : ch3volts=byte%/51
    if ch%=4  then  select1%=2 : select0%=0 : ch4volts=byte%/51
    if ch%=5  then  select1%=2 : select0%=2 : ch5volts=byte%/51
    if ch%=6  then  select1%=2 : select0%=2 : ch6volts=byte%/51
    if ch%=7  then  select1%=0 : select0%=0 : ch7volts=byte%/51
    byte%=0
   next ch%
  print using
  "##.#";ch0volts, ch1volts, ch2volts,ch3colts,ch4volts,ch5volts,ch6volts,ch7volts
    wend
```

GWBASIC Version

```
10 ' The following program causes the A-D convener to perform eight
20 '  sequential conversions and display the result.
30 SCREEN 0                          'text mode 80 columns
40 COLOR 14,0                        'yellow on blue
50 CLS                               'clear the screen
60 CLEAR                             'clear all variables
70 TOGGLE%=2                         'initialize variables
80 ODDSIGN%=0
90 IF INKEY$<>"" THEN END            'keep going until a key is pressed
100 OUT 888,1                        'regulator line high
110 OUT 888,0                        'light up the regulator
120 FOR W%=0 TO 500:NEXT W%          'wait 54 mseconds to stabilize
130 FOR CH%=0 TO 7                   'scan 8 channels
140 OUT 888,8                        'CS high  pin 5
150 OUT 888,0                        'CS low
160 OUT 888,2                        'start bit is always high DI line
170 OUT 890,0                        'clock high pin 1 of DB 25 printer
180 FOR SLOW%=0 TO 1:NEXT SLOW%      'stretches clock pulse
190 OUT 890,1                        'clock low
200 OUT 888,2                        '8 single ended measurements selected
210 OUT 890,0                        'clock high
220 FOR SLOW%=0 TO 1:NEXT SLOW%      'stretches clock pulse
230 OUT 890,1                        'clock low
240 OUT 888,ODDSIGN%                 'part of the channel selection string
250 SWAP ODDSIGN%,TOGGLE%            'toggles between high and low
260 OUT 890,0                        'clock high
270 FOR SLOW%=0 TO 1:NEXT SLOW%      'stretches clock pulse
280 OUT 890,1                        'clock low
290 OUT 888,SELECT1%                 'part of the channel selection string
300 OUT 890,0                        'clock high
310 FOR SLOW%=0 TO 1:NEXT SLOW%      'stretches clock pulse
320 OUT 890,1                        'clock low
330 OUT 888,SELECT0%                 'part of the channel selection string
340 OUT 890,0                        'clock high
350 FOR SLOW%=0 TO 1:NEXT SLOW%      'stretches clock pulse
360 OUT 890,1                        'clock low
370 REM                              'read output bits
380 FOR BIT%=7 TO 0 STEP -1          'MSB is first out
390 OUT 890,0                        'clock high
400 FOR SLOW%=0 TO 1:NEXT SLOW%      if ad%'stretches clock pulse
410 OUT 890,1                        'clock low
420 AD%=INP(889)                     'port 889 pin 10  7-low  135-high
430 IF AD%<120 THEN BYTE%=BYTE%+(2^BIT%)
440 NEXT BIT%
450 IF  CH%=0  THEN  SELECT1%=0 : SELECT0%=0 : CH0VOLTS=BYTE%/51
460 IF  CH%=1  THEN  SELECT1%=0 : SELECT0%=2 : CH1VOLTS=BYTE%/51
470 IF  CH%=2  THEN  SELECT1%=0 : SELECT0%=2 : CH2VOLTS=BYTE%/51
480 IF  CH%=3  THEN  SELECT1%=2 : SELECT0%=0 : CH3VOLTS=BYTE%/51
490 IF  CH%=4  THEN  SELECT1%=2 : SELECT0%=0 : CH4VOLTS=BYTE%/51
500 IF  CH%=5  THEN  SELECT1%=2 : SELECT0%=2 : CH5VOLTS=BYTE%/51
510IF  CH%=6  THEN  SELECT1%=2 : SELECT0%=2 : CH6VOLTS=BYTE%/51
520IF  CH%=7  THEN  SELECT1%=0 : SELECT0%=0 : CH7VOLTS=BYTE%/51
530 BYTE%=0
540 next ch%
550 PRINT USING"##.#";CH0VOLTS, CH1VOLTS, CH2VOLTS,CH3COLTS,
    CH4VOLTS,CH5VOLTS,CH6VOLTS,CH7VOLTS
```

fit the other pad. Do the same with the remaining components.

Position the chips on their respective solder pads just to make sure that the legs are bent properly. Make any corrections, then remove the chip and tin the pad for pin 1. Position the chip again and hold it in place under light pressure. Melt the solder on the pad until the leg is settled into the solder. Perform the same operation on pin 11, then the remainder can be soldered without applying any pressure.

Position the surface-mount regulator carefully on the pads and hold it under light pressure with a pencil eraser. Put a glob of solder on a clean iron and touch it to a pad until the solder flows around the regulator leg. There are six legs on the regulator, but legs 2 and 5 are not used.

The Sky's the Limit

Given the simple nature and small form factor of this project, it lends itself well to aerial telemetry. DTMF encoders and decoders use 5-volt logic levels too, so it seems possible to use a computer on the ground to communicate with an ADC aboard a balloon or kite, using two low power VHF transceivers and some heavy-duty programming.

A group of local youngsters want to build and fly a huge kite. I suggested they make a science project out of it by attaching some data recording equipment and a camera. We may monitor wind speed, temperature, altitude, solar radiation, force on the string, and a few other things not yet defined. We should be able to aim and fire the camera using a computer on the ground too. 73

Contact Mike Gray N8KDD at 465 W. Maple Rd., Milford MI 48381.

Specifications

Input impedance: 30k ohms
Power consumption:
Sleep: 9 milliwatts
Wake: 100 milliwatts
Analog input: 0-5 volts
Temperature limits: 0 degrees-C

Parts List

1	A-D converter National ADC0838CCN or ADC0838CCJ
1	1 meg resistor block (contains 8 resistors)
1	Toko surface mount regulator, 5 volts
2	10k 1/8-watt resistors
1	4.7k 1/8-watt resistor
1	10 uF capacitor
1	9-volt battery clip
1	SPST toggle switch
1	470 ohm resistor
1	Low power LED
1	ABS enclosure with battery compartment
1	DB-25 connector (male)
1	DB-25 connector shell
1	6-conductor cable
10	Screw terminal blocks

Note: The following kits are available from the author: M-LOG programs and a circuit board only, $25; M-LOG programs, circuit board, and components, $60; enclosure kit (box, switch, LED, terminal blocks, graphics), $30. Add $3 shipping. Write to Mike Gray N8KDD at 465 W. Maple Rd., Milford MI 48381.

73 Review

by Michael Jay Geier KB1UM

The Yaesu FT-415 Handheld

A full-featured 2m mini-HT.

Yaesu USA
17210 Edwards Rd.
Cerritos CA 90701
(310) 404-2700
Price class: $409

Yaesu's new FT-415 is an interesting melding of the FT-26 and the FT-411. It incorporates nearly all of the FT-411's features, along with the DTMF paging and squelch of the FT-26. It is styled like the '26, with a slightly thicker case than the 411's, but reduced size in the other dimensions. It is sculpted and rounded, so it feels comfortable.

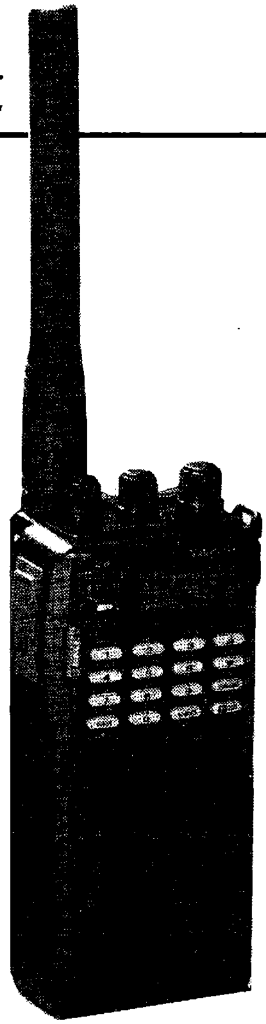
Basics

This is a full-featured radio. It includes all of the goodies we've come to expect from today's high-tech rigs, along with a few brand-new ones. Receive coverage is Yaesu's now-standard 130-174 MHz, and transmit is 140-150 MHz. Power output with the standard battery is 2 watts on high. There are 41 memories, each capable of holding independent TX/RX frequencies, CTCSS tone and configuration, etc. DTMF paging is included.

Although CTCSS is listed in the manual as an option, it comes installed on all USA/Canada rigs, as it always has on the FT-411 (but not on the FT-26).

The radio is noticeably smaller than the FT-411, except for its slightly increased thickness. The PTT switch area does not stick out as far, and the rubber PTT, Monitor and Lamp switches are curved for better ergonomics. It looks much nicer, but I'm not sure that it really works; I found the '411's PTT less fatiguing to press than the new version. Also, I sometimes find myself turning the lamp on when I press the PTT. The 16-button keypad controls almost everything; there are no hidden switches on the back. The "call" button, which selects your favorite frequency at the touch of one button, is on the front, near the PTT switch area, and is easier to get at than the '411's was. On top, next to the mike and earphone jacks, is a coaxial jack for direct DC input. The rig can operate on 5.5 to 16 volts, so you can power it from your car. At 12 volts, output is 5 watts. The rig is fairly weather-proofed, with a rubber cover over the jacks and a grommet around the antenna jack. The manual says it is ruggedized and I believe it; this thing feels solid as a rock.

The antenna is the same as the one on the FT-26: way too stiff. Also, its cover is not securely attached and turns freely, making antenna removal difficult. It seems that most walkie manufacturers like to change their ducks' styles every now and then. Yaesu might want to rethink this one.



The Yaesu FT-415 HT.

The included 600 mAh NiCd battery pack also is the same kind as used on the FT-26. It can be charged with the standard wall charger in about 15 hours, or with the optional quick charger in about an hour. Along with several sizes of rechargeable packs, there's an optional AA cell holder, which can be mighty handy in public service work or when you travel and don't want to bring a charger along. By the way, this new battery style does not fit on the FT-411 and previous units.

It Does It

This radio has every feature you could want, and then some. Anything you want it to do, it does it. It has all the usual scan and priority modes, along with a programmable battery saver and automatic power-off timer. The battery saver has the new feature also included on the FT-26: It can analyze your operating habits and typical channel activity and set itself for optimum operation with the least intrusive characteristics. If you don't want it to do that, you can set it to one of five fixed on/off ratios or turn it off altogether for packet operation. When you select the saver ratio, the time between "wake ups" is displayed in seconds. It's pretty slick. There are four RF output power levels, but only three are available at the normal 7.2 volts supplied by the standard battery. Still, that's one more than you usually get. To save even more power, you can elect to disable the front-panel "busy" LED. I don't understand why an LED is even used; this function could be shown on the LCD with no added power drain. But, it's nice to be able to save the 5 mA or so the LED eats.

Frequencies may be entered with the keypad or by using the top-mounted rotary tuning control. This configuration has pretty much become standard these days, and it works well. The rotary tuning knob can shift the frequency by either the nominal step you have selected (such as 5 kHz) or by 1 MHz in conjunction with the MHz function available on the keypad. When you enter frequencies directly from the keypad, you must enter all the digits, including the leading "1." There's even an option which lets you enter "splinter" channels (in between the normal 5 kHz channels) without changing the basic tuning step.

Like the FT-411, the '415 has two VFOs, and any memory can be used as a VFO as well. Pressing one button converts whatever memory channel you are on into a tunable memory, which is no different at all from a VFO. If you wish to replace the memory contents with the new frequency you have found, you may do so. You also may put the new frequency into a different memory without disturbing the memory from which it came. Finally, you may simply ignore the new frequency and return to the original memory with no harm done.

The front-mounted LCD shows operating frequency, memory channel number, VFO A or B, and other functions such as CTCSS status. It appears identical to the display on the '26, and is very nice. It shows the full frequency, including the final zero or five, and I like that. The display can be backlit by pressing the lamp button just below the PTT switch. The keypad lights up at the same time, making night operation very convenient. Green LEDs are used for both the keypad and the LCD; gone is the incandescent lamp on the '411. The lighting can be set to stay on for five seconds after the last key press, or to stay on until you press the lamp button again, which is nice for nighttime mobile operation from car DC power. For normal battery operation, the five-second time-out is especially handy. Of course, you can turn the lights off any time you want simply by pressing the lamp button.

The rig can scan the band, a selected portion of the band, or the memories. Scanning the band, or a portion of it, from the VFO is very fast. Memory scan, however, is only about half the speed of the '411. Still, it's as fast as most rigs; the '411 was exceptional in that regard.

Memories can be locked out in two ways. SKIP hides the memory channel from the scan, but you can still get to it via the tuning knob or by entering the channel number from the keypad. It's great for the NOAA weather channel or other busy frequencies. HIDE erases a memory completely, except that you can "unhide" it later and get it back. I find this feature to be especially useful for travel. If you often visit different cities, you'll love it. But, as on previous Yaesu walkies, each memory channel must be hidden and retrieved separately. It would have been nice if there were some way to manipulate whole ranges (such as 20-29) at a time, but it still beats having to re-enter all those frequencies. There's an improvement over previous rigs, though. It used to be that when you hid a memory, the rig dropped back to memory number 1 after each HIDE operation. It was a real pain to hide an entire range because you had to enter each memory number and essentially start over for each one. The new rig simply drops back to the first unhidden previous memory. So, if you hide channel 5, it drops back to channel 4, assuming that one is unhidden. This makes it much easier to get rid of an entire range, especially if you start at the highest number and work backward.

The memory management scheme of this new radio is essentially identical to the time-proven, easy-to-use design of the FT-411. It will even scan up or down the band from the memory. After scanning to a new frequency, you can store it in any memory channel or a VFO, or simply return to your original memory channel, disturbing nothing. It's all very easy to do and easy to remember.

The FT-415 has some new features, including DTMF paging, four power level choices, an automatic battery saver, lighting options, selectable two-second TX hang time during DTMF dialing, CTCSS scanning (it'll decode and display incoming tones!), and lots more. In order to accommodate these new capabilities, a new SET mode, similar to the one used on ICOM walkies, is included. Many of the infrequently used set-up commands are grouped in this mode, keeping them out of your way until needed. The key presses seem straightforward enough, but you probably will need to refer to the manual for the ones you don't use very often.

Like the FT-411, this new rig has a 10-number DTMF autodialer. Each number can have up to 15 digits, and sending them is as easy as touching one button while you're transmitting. (Some rigs make you press as many as four buttons, negating the whole point of an autodialer.) The procedure for entering the numbers is the same cryptic system found on the '411, and I think it could be made easier. Once you get the hang of it, though, it's not too bad, and it's definitely worth it. Naturally, you also may send numbers manually, without entering them into memory first.

Documentation

The manual is first-rate. Like other recent Yaesu booklets, it's written in clear English. I wish other manufacturers would put this much effort into their instructions. A full set of schematics is provided, and there's a lovely wallet-sized cheat sheet. This sheet, unfortunately, doesn't show some of the SET functions, but it has all of the operations you're likely to want out in the field. It's made of a coated paper which seems designed to last a long time.

Using It

Transmitted audio sounds clear. The receiver is very sensitive, even outside the ham bands. It's a definite improvement over the '411s. Selectivity is very good, but doesn't seem quite as sharp as the older rig. Still, it's better than on many other walkies, and more than good enough. Unlike most walkies the 415's front end filters are varactor controlled by the PLL tuning voltage, so they are always tuned to the operating frequency. This Advanced Tracked Tuning technique keeps the sensitivity high and helps avoid intermod problems.Overall, the receiver seems excellent. I tried the rig on packet using the Poor Man's Packet modem I built up for my '411, and it worked great. Naturally, I turned the battery saver off first!

Not Perfect

Each generation of walkies gets better than the last. This rig is really great, but it does have a few quirks and annoyances. Here are some I found.

There's one bug that's a carry-over from the '411: When you are in the CALL memory, if you turn the dial knob, it transfers the contents of the memory into the last-used VFO, trashing whatever was there. It can be a real pain when you inadvertently lose a stored frequency that way.

The rig is touted to have improved receive audio by virtue of a better speaker. It's true. Despite the small grille area, the speaker reproduces bass frequencies much better, making most voices (especially men's) sound richer and clearer. The audio obviously is better than on previous models.

The DTMF squelch and paging features use the now-standard three- and six-tone sequences, with the numbers being limited to 0-9. Unfortunately, most repeater controllers won't pass DTMF tones unless they're prefaced by some codes containing the * and #, which you can't send. This limitation makes the features fairly useless, especially in the big cities where you'd most like to use them. This problem isn't limited to Yaesu, though; all the DTMF-squelched rigs use the same system. Of course, it's nice for simplex and hamfest use.

The same blinking battery icon that was on the '411 is present on the new rig. Like the old one, it doesn't give you much warning when your battery is about to die. A voltage monitor would be far preferable. Even though NiCd batteries don't change voltage much over their discharge period, there's enough change near the end to give you more warning than the icon does.

The rig gives you the option to substitute DTMF tones for the annoying musical keypad beeper. It's an improvement, but still not great. It would be nice if there were an option to change the beeper into a single short tone, like it used to be on older walkies, perhaps with a double tone for those functions whose status is announced via the beeper.

The NC-42 Quick Charger

Along with the review rig Yaesu sent the NC-42 quick charger. This small, light unit sits on a desktop. It has no on/off switch; it turns itself on when you insert the battery. It begins in the quick mode and brings the battery to a nearly full charge in about one hour. It then switches to the trickle mode, topping off the charge. Two LEDs announce the charge mode. It works well and is very convenient, but it suffers from one problem: It throws the worst TVI I've ever seen! I have some Sony miniature switching power supplies which have the same problem, but they're not nearly this pronounced. This thing puts garbage on any TV screen in the house, including my set which is hooked up to the outdoor antenna via coax. Some shielding is in order here! Wouldn't it be ironic to get complaints from your neighbors about your *battery charger* instead of about your transmitter? *[Ed. Note: Yaesu is currently looking into this.]*

Conclusion

This radio represents the state of the art in miniature single-band walkies. No, it isn't the very smallest available, but it's certainly small enough! It works well and has more features than you'll probably ever use. Considering the wealth of functions, the user interface is very reasonable and unintimidating. This rig's a beaut! 73

Protected AC Outlet for the Workbench

Avoid a shocking experience.

by Michael A. Covington N4TMI

My most-used test bench accessory is a switched AC outlet with a ground-fault circuit interrupter (GFCI) and a precision 0.1-ohm resistor.

Photo A shows what it looks like. The GFCI is a standard model from a hardware store, mounted in a not-too-precisely-cut hole in the enclosure. It serves three purposes: to help keep me from getting shocked; to detect potentially unsafe equipment; and to let me know whether any piece of equipment is going to trip a GFCI, even for harmless reasons.

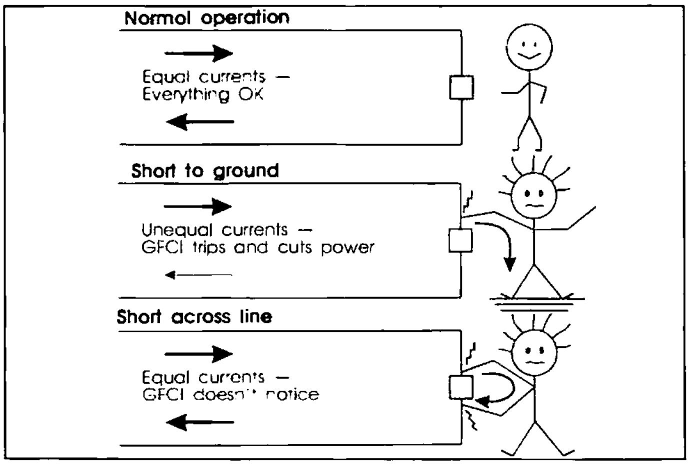


Figure 1. The ground-fault circuit interrupter (GFCI) senses mismatched currents in "live" and "neutral" wires and cuts off power. This doesn't prevent all electric shocks—only those involving a short to ground (middle example).

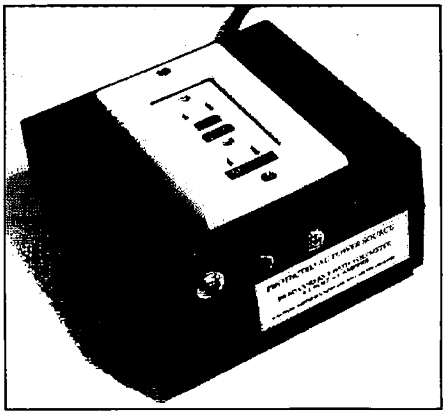


Photo A. This device consists of a GFCI (ground-fault circuit interrupter) in a convenient enclosure with a switch.

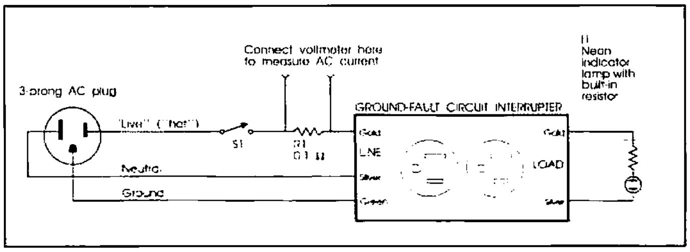


Figure 2. The protected outlet box consists of a GFCI, a switch, a 0.1 ohm resistor for measuring current, and a pilot lamp. Correct identification of live, neutral, and ground wires is VERY important. Most power cords use the black wire for the "hot" live lead; the white wire is the neutral and the green wire is the ground.

Figure 1 shows what a GFCI does: It checks whether the currents in the "live" and "neutral" wires are equal, and, if not, cuts off the current. This doesn't prevent all electric shocks, but it does prevent or shorten those that involve an accidental connection to ground.

The circuit is shown in Figure 2. Ahead of the GFCI are a switch and a 0.1-ohm resistor. The switch, naturally, cuts power on and off. It should be rated for as many amps as your load will ever draw (typically 10 or so).

The resistor lets you measure AC current accurately—just connect a voltmeter across it and read each volt as 10 amps. An 0.1-ohm, 10-watt resistor may be a bit hard to find; the easiest solution is to use five 0.47-ohm, 5-watt resistors (Radio Shack 271-130) in parallel.

You'll also need two pin jacks for the voltmeter. Remember that both sides of the resistor are "hot" with respect to ground; *don't* use any kind of jack that could make accidental contact with something or someone outside. Binding posts are not suitable. The Radio Shack 274-725 banana jacks are *barely* acceptable if clearly marked with a warning label; jacks with much smaller holes are preferable, and can be found at hamfests or on junked test equipment. Or you could make something of your own that mounts behind tiny holes drilled in the plastic panel.

The GFCI can come from any hardware store. It's essential not to mix up the live ("hot"), neutral, and ground wires in the power cord and on the GFCI. In most power cords the black wire is the "hot" lead, the white wire is the neutral and the green wire is the ground. The switch *must* be in the live ("hot") wire. Also, be sure to distinguish the input ("line") side of the GFCI from the output ("load"). Across the load side of my GFCI I wired a neon indicator lamp so that I can see at a glance whether power is on. ■

Contact Michael A. Covington N4TMI, 285 Saint George Drive, Athens GA 30606.

Parts List

S1	SPST switch, rated for 125V AC, 10 amperes (Radio Shack 275-324 or equivalent)
R1	0.1-ohm, 10 watt resistors (actually five 0.47 ohm, 5-watt resistors in parallel, Radio Shack 271-130)
I1	Neon lamp "power on" indicator with built-in resistor (Radio Shack 272-712 or equivalent)
GFCI	Ground fault circuit interrupter (from hardware store or electrical supply house)
	Pin jacks for voltmeter connections (see text)
	Enclosure
	3-prong AC plug and line cord

HAM HELP

Number 13 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (81/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Needed: Manual for Heath Kit LG-1 generator; also schematic/manual for a Lafayette LA-950 stereo amp. Copies are fine. I will pay. *Buz Chadwick N4GTX, PO Box 1381, Palatine IL 60078. Tel. (708) 358-3603.*

I am trying to locate either owners manual or schematic for Regency HR-2A 2 meter transceiver. I will pay to copy, or will copy and return. *Ted Webb AC4CS, 118 Seabury Dr., Greenville SC 29615.*

I need information on replacement parts for a Heath IM-28 VTVM that was modified to a TRVM. The Heath part numbers are: 150-57 TR1002 SS diode which is a replacement for a 6AL5, and 150-58 TR1119 SS triode which replaces a 12AU7. These are called FETRONS or HINS. Any help in locating these parts, or specification sheets on any FETRONS would be appreciated. The other FETRONS I have are TR1006, TR1008, TR1010, TR1157, and TR1126A. *Bob Juranek, 11469 Haggerty, Plymouth MI 48170-4455.* Tel. *(313) 459-7718.*

I would like to get in touch with hams who have experience with Yaesu CAT programming, particularly with the FIF-232 connected to an FT-757GXII and using some form of BASIC language on an IBM PC compatible machine. *Bill Schwiegeraht N8KSG, 1576 Karahill Drive, Cincinnati OH 45240. (513) 247-4561 days; (513) 851-9698 eves., collect; FAX (513) 247-4561, or e-mail for Prodigy user ID # BHKD13A.*

I would like to contact former students of Nathaniel Narbonne High School (ex WB6RTO) in Harbor City CA, who got their novice license between 1965 and 1976. We are going to have a reunion! *Marv Fagenson K6HCJ, 2100 Sawtelle Blvd. Ste. 202, Los Angeles CA 90025. Tel. (310) 478-1777.* Thank you.

Wanted: Genuine Hayes Modem 1200, model with 10 dip switches. Please write to *William Petrisko, PO Box 42376, Tucson AZ 85733 or e-mail petrisko@evax2. engr.arizona.edu.* Thanks.

SAY YOU SAW IT IN *73*!

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Korean Star Rising

In late July a new *amateur-radio* satellite is scheduled for launch from Kourou, French Guiana. If all goes well, the satellite, KITSAT-A, will become an OSCAR (Orbiting Satellite Carrying Amateur Radio). The satellite builders in England have announced further payload details since the brief system description presented in the April 1992 "Hamsats" column.

The University of Surrey in England teamed up with the Korean Advanced Institute of Technology (KAIST) in 1990 to begin a joint educational effort to build a satellite adhering to the IARU (International Amateur Radio Union) definition of an amateur-radio satellite. The project has progressed rapidly through the cooperative efforts of the experienced UoSAT engineers and the KAIST student-engineers. KITSAT offers all the qualities built into UoSAT-OSCAR-14 and 22, but with some new and exciting features.

Current Technology

KITSAT-A carries a packet communications system with a digital store-and-forward unit like its predecessors, but with 13 megabytes of memory. Due to the availability of mature high-speed communications software, KITSAT will go to orbit ready for operation by any station currently active via U-O-22. Over the more populated parts of the world, U-O-22 has been full to capacity with user file transfers. The 9600 bps (bits-per-second) format of U-O-22 activity has performed very well and will be continued with the new satellite.

U-O-22's Earth Imaging System has proved quite functional and popular. Pictures of the Persian Gulf area during the Kuwait war clearly showed plumes of smoke from the burning oil-well fires. KITSAT carries a similar camera system. The basic CCD (charge-coupled device) unit has a resolution of four kilometers.

KITSAT Advances

Higher data speeds are possible with KITSAT. Although the main system is designed for 9600 bps, experiments are planned using digital signal processing up to 38,400 bps. KITSAT Project Manager Jeff Ward GØ/K8KA is enthusiastic about the incorporation of very-high-speed data communications through an amateur satellite, but is most intrigued by the new imaging equipment.

One of the most exciting additions to KITSAT is a second CCD camera with a telephoto lens assembly. It provides up to a 400 meter resolution. This level of definition allows identification of man-made structures from space. The wide-angle camera can be used to spot areas of interest while the telephoto system can zoom in on the target area.

The cameras are just one part of the complete Earth Imaging System (EIS). Both CCD units are connected to a Transputer Image Processing Experiment (TIPE). Manipulation of the image data can be performed in orbit prior to transmission to earth without heavy reliance on other computing resources on the spacecraft.

KITSAT carries a Digital Signal Processing Experiment to be used for speech synthesis, store-and-forward voice messages, and high-speed data modulation and demodulation.

Hamsat satellite telemetry has been sent by voice synthesizers listing numeric sequences for over a decade, beginning with UoSAT-OSCAR-9. Simple words and phrases have also been possible. The KITSAT system is capable of multilingual messages. The speech system is limited only by the imagination of the programmers.

The Korean Amateur Radio League is working in conjunction with KAIST to develop simple, dedicated handheld receivers for KITSAT reception. Plans are to distribute these inexpensive 70cm units to schools. Messages of all types will be loaded into the satellite's memory for broadcast to amateur radio operators, experimenters and educational institutes.

Other experiments with the voice message forwarding potential of the system have not been defined but will begin when the satellite is in orbit. Real-time conversion of a digital uplink signal to an FM voice downlink for repeater style operation is a possibility.

AMSAT-OSCAR-10 and Fuji-OSCAR-12 were both severely affected by radiation damage. Amateur-radio satellite designers are increasingly interested in studies of the effects of radiation on all types on electronic circuits. Radiation detection experiments have been flown on previous amateur satellites, but at low altitudes.

KITSAT carries a Cosmic Ray Experiment (CRE) to measure total radiation dose encountered by the spacecraft and to detect highly-energetic cosmic rays. All the satellite's onboard systems, including the computers, power systems, memories and solar cells, will be monitored.

Phase-3-D, the current high-orbit satellite under construction, will encounter radiation levels similar to those seen by KITSAT. Information obtained from the KITSAT measurements will be extremely useful to Phase-3-D designers. Data formats will be available from the KARL, KAIST and the University of Surrey via AMSAT-UK.

The primary payload traveling with KITSAT is an oceanographic satellite, *Topex/Poseidon*. A microsatellite, S80-T, will also go up on the same late-July flight of *Ariane V-52*. The anticipated orbit is circular with an altitude of 1330 kilometers and a 66-degree inclination. No other OSCAR has been placed in such an orbit.

The inclination, or angle of the orbital plane with respect to the equatorial plane (equator), for KITSAT is not as high as other low-earth-orbit hamsats. Most are in polar orbits with inclinations of at least 80 degrees (90 degrees would be directly over the poles). KITSAT's inclination is also not as low as a high-inclination shuttle orbit (typically 57 degrees). The result of the 66-degree inclination will be noticed by those in high latitudes since the orbit will have characteristics similar to the shuttle, but at a much higher elevation.

An altitude of 1330 kilometers is similar to that of AMSAT-OSCAR-7, which is currently circling the earth near 1460 kilometers. For those who were active via A-O-7 in the '70s, antenna pointing was relatively easy and passes lasted long enough to make several contacts. DX was even possible from south Texas to parts of Western Europe. RS-10/11 is near 1,000 kilometers, while the current microsats and UoSAT-OSCAR-11 are even lower. KITSAT's orbit will provide users with longer access times and slower apparent Doppler-shift-to-signal frequencies.

Communications Via KITSAT

Operation via KITSAT will be easy for those already on U-O-22. The satellite's frequencies are shown in Table 1. KITSAT transmits and receives 9600 bps FSK using the AX.25 protocol. The programs currently available of U-O-22 access will allow telemetry files, experiment data, picture files from the cameras and user-uploaded files and messages to be downloaded.

Sources at the University of Surrey anticipate that 95 percent of the satellite's operating time will be devoted to normal 9600 bps communications. The rest of the time will be used for experiments with voice, higher-speed data and other DSP activities.

KAIST earth station HLØENJ in South Korea will manage KITSAT's activities, while the University of Surrey in England will provide advice as needed. Current plans focus on operating KITSAT as a satellite dedicated to the amateur radio satellite service. Exciting times are on the horizon for the first hamsat *sponsored by South Korea*.

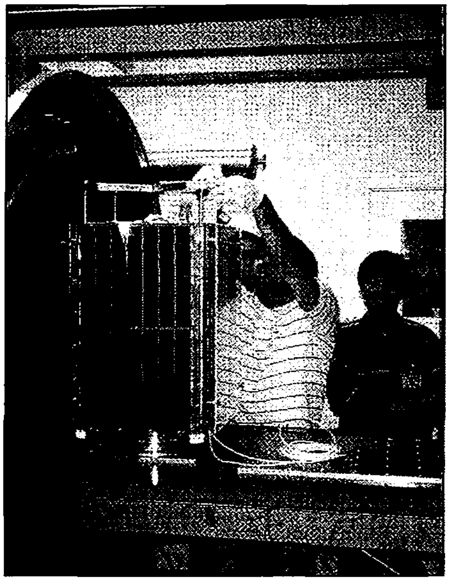


Photo A. The KITSAT-A microsatellite enters thermal-vacuum testing (5/11/1992). H.S. Chang removes the lifting frame as H.S. Kim looks on. Photo by J.W. Ward GØ/K8KA.

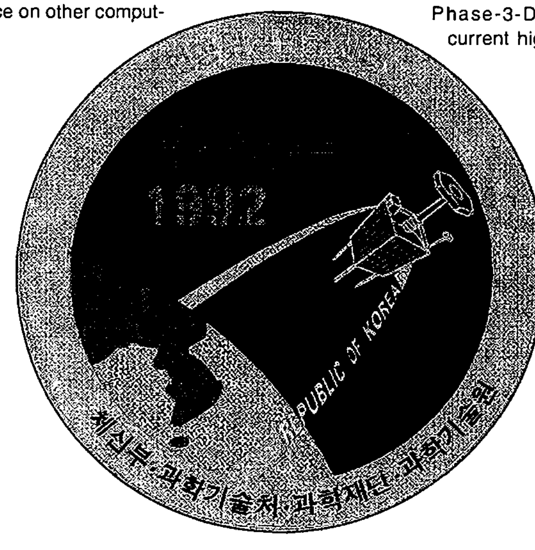


Photo B. The KITSAT-A logo.

Table 1. KITSAT-A Frequency Chart

UPLINKS:	145.850 MHz	Primary access channel
	145.900 MHz	Secondary access channel
DOWNLINK:	435.175 MHz	

HOMING IN

Number 15 on your Feedback card

Radio Direction Finding

Joe Moell, P.E., KØOV
PO Box 2508
Fullerton CA 92633

RDF Opportunities Abroad and at Home

Enhancing international good will and advancing communications and technical skills are two of the live purposes of amateur radio. We all know that because it says so in the beginning of FCC Part 97. Radio Direction Finding (RDF) competitions are a perfect way for hams to do both and have a barrel of fun at the same time.

As I write this, it has been a month since this column broke the news of an invitation for U.S. foxhunters to participate in the Ukrainian RDF Championships in September (see "Homing In" for April 1992). I am astonished at the small response so far.

John Douglas NØISL, Technical Director of the Foundation for Amateur International Radio Services (FAIRS), reports only a trickle of inquiries so far. One of the respondents is of Ukrainian descent, intrigued with the program mostly because of the opportunity to visit his homeland.

Why haven't hams jumped at the chance to take part in an adventure like this? John suspects that some may fear the political situation in that part of the world. He points out that unrest is severe in Armenia, Georgia, Moldavia, and Azerbaijan, but not in the Ukraine and central Russia. Besides, your hosts will be taking good care of you.

"It was almost amusing the way we were guarded and herded on our last trip," John says. "There's always the risk of some sleazy guy sliding up to you on the street and saying, 'Do you want to buy some rubles?' But you can see him coming half a block away. As one would start to approach, about six very loud Russian hams would be between me and him, and he would be gone." Instead of the tourist hotels, RDFers are invited to stay in Ukrainian hams' homes. You won't be sampling night life in the evening. Instead, you will probably be at someone's ham station, working the world.

"Lvov is a very European city, 40 miles from the Polish border," John says. "The best way to get there is to fly to Moscow, then take the overnight train for the 700-mile trip to Lvov. Travel on the train is an absolute joy. You see the countryside from European style coaches with tables and a matronly old lady who insists that you drink all the tea you can. The people are as warm and sharing as any I have ever known."

Soviet hams are just as innovative as hams anywhere else, but they lack many of the resources we take for granted. If you think getting parts for your do-it-yourself ham gizmos is hard, imagine the plight of hams in former iron-curtain countries.

John tells of his experiences on the train, meeting foxhunt organizer Igor Shewchuk UB5SBD. "He brought some hand-built foxes that he was working on, which also did the scoring and offloaded via 2 meters all of the competitors' check-in times (Photo A). It had an optical reader and he was hand-manufacturing all the little optical cards. He wanted me to look at it, suggest some changes and see if I could get him some parts." Time is getting short to make arrangements for this event. UB5SBD says, "You Americans don't have to send your champions. We'd love to show it to anyone who is interested."

If you think you're ready for a world-class foxhunt, and you think you would make a good ham ambassador, write to NØISL at 19164-147th Street NW, Elk River MN 55330.

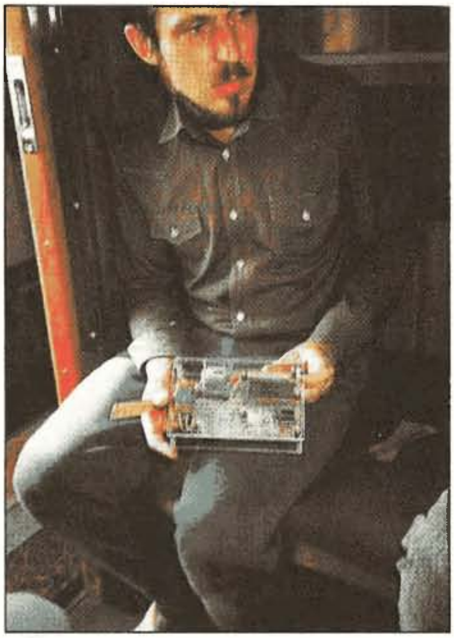


Photo A. Igor Shewchuk UB5SBD shows off his computer-controlled fox-box on the train ride to Lvov. Hunters check in by inserting an optical card into a reader, which records competitors' times and transmits this data via radio link to the judges. (Photo by NØISL)

Photo B. Radio foxhunting has long been a popular children's sport in Europe and Asia, but nowhere more than in the former Soviet Union, where it was sponsored by the military and taught in the schools.

East and West—Different Styles

It is clear to me that there would be more interest in the Lvov opportunity if there were more similarity between RDF contesting in the USA and foxhunting in the rest of the world. European and Asian hunts are all on foot, with multiple transmitters on a course that covers several kilometers. Unless you are in great physical condition, you're doomed to an embarrassing rear-guard finish in these sprints.

While there are several age categories, international foxhunting is primarily a sport for young boys and girls (Photo B). The primary purpose is to teach and reward physical conditioning and orienteering skills, with radio/electronics proficiency as a secondary aspect. The vast majority of European contestants are not licensed hams.

Here in the USA, hams don't think of transmitter chasing as a body building activity. We go T-hunting for a social experience or for a technical challenge. Unlike elsewhere in the world, we have the additional freedom to use our RDF skills for self-policing or to aid in volunteer search and rescue. It is an activity for ham clubs, not youth groups.

By not having the opportunity to participate in radiosports, young people in the USA are missing out on a good thing. Over the years, other international sports (like soccer) have found their way into our schools, so why not foxhunting?

Perhaps some of you readers are in a position to help make this happen. If you are a teacher who is including ham radio in your curriculum (Bless you!), consider adding foxhunting to the activities. No more classroom time available? How about putting it into your school's physical education program? I would have enjoyed foxhunting more than any other activity we did in phys. ed. when I was a kid.

Are you into orienteering? There are so many similarities that orienteers should feel right at home on a foxhunt course. I'd like to hear from people who can tell me how to get orienteers and foxhunters together.

NØISL would like to see two-way exchanges with UA-land foxhunters. "We could invite a young Russian or Ukrainian here with his RDF gear and have him teach it to clubs or interested groups," he says. "If three ham clubs picked up the cost of getting one here, and split the housing for a couple of days each, we're talking about a very small budget."

What are your thoughts? Write me at the address above. I try to answer the mail promptly. (Hint: Letters including self-addressed stamped envelopes go to the top of the pile.) You can also catch me on CompuServe (75236,2165) or Internet (JoeMoell @cup.portal.com).

Turning to Technical Topics . . .

At the end of a mobile T-hunt, you often have to get out of your car and beat the bushes. That part of the hunt is called the "sniff." Sniffing your way to a concealed 146 MHz transmitter is tricky if all you have is a 2 meter handheld rig.

The "body shield" sniffing technique loses its effectiveness as you approach a high-powered T because you can't attenuate the signal enough to determine direction and level changes. You can try tuning 5 or 10 kHz off frequency to knock down the signal, but the effectiveness of that ploy depends greatly on the modulation characteristics of the fox's signal.

You can build special sniffing gear, such as field-strength meters and du-

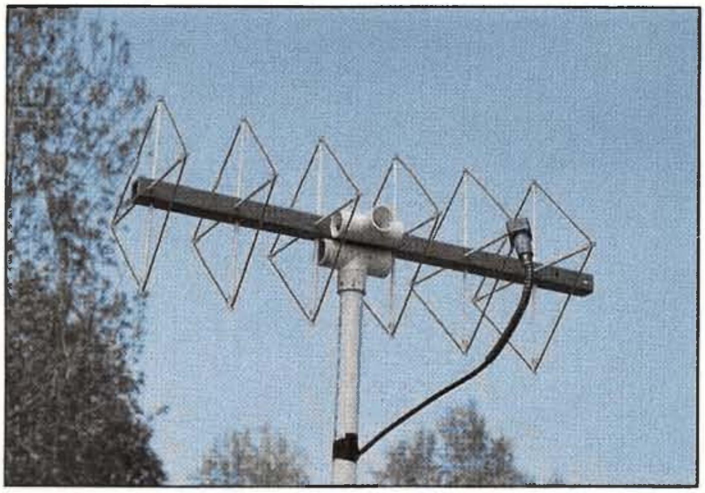


Photo C. Quads for 440 MHz are compact and highly directional. This is a commercial model made by Alabama Amateur Electronics, modified for mast connection at the center of gravity, with a ferrite balun added.

al-antenna RDF sets. But the handheld would be good enough if you could just get the hider to reduce power by 60 dB as you get within striking range. If you have a dual-band (2 meter and 70 centimeter) HT, you can get the same effect by sniffing the third harmonic.

FCC rule 97.307(e) limits the allowable harmonic power of 2 meter transmitters. If the hidden T runs less than 25 watts, each harmonic may not exceed 25 microwatts. If you think that's too puny for sniffing, think again.

"Every 2 meter transmitter I've hunted has put out enough third harmonic to make it sniffable once I'm in walking range," says Martin Hasa KB6MAH, who has used this trick for some time.

Not only does switching to the third harmonic give you instant attenuation, it also allows you to use a smaller, highly directional antenna for the sniff. Elements on a 70cm quad are only 6-1/2 inches on a side. The quad shown in Photo C has a boom length of 21 inches. You can carry it with the attached mast as shown, or eliminate the mast and just hold it by the rear of the boom.

Many scanners receive the 70cm band, but most don't have S-meters, so it's harder to get good bearings with them. A dual-band HT modified for extended receiver frequency range (to go below 440 MHz when the T-hunt is on 146.665 or below) is ideal.

(Here is an "electronic countermeasures" hint for hiders: If you think hunters will be sniffing on your third harmonic, use the maximum legal level of deviation. If you run +/- 5 kHz deviation on 2 meters, your 70cm harmonic will deviate +/- 15 kHz, exceeding the passband width of most UHF receivers. They will still be able to hunt you, but it will be more difficult.)

Pattern Perfection

Quads for 70cm are an easy home-brew project, or you can buy one ready to go. Not only are they fine for harmonic sniffing, but they are used in my area for mobile hunts on 446 MHz FM.

Note in the photo the non-metallic (PVC pipe) mast and tee couplings I use to preserve the quad's directional pattern. There are two tee fittings fastened to the boom, one for vertical polarization and the other for horizontal. The hider is allowed to use either polarization, so quick changing is important.

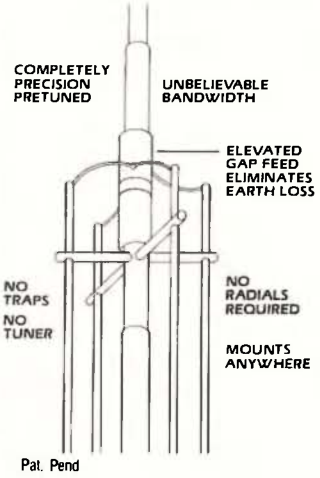
The directional pattern of a quad is never perfect. Unwanted side lobes and back lobes can show up for a number of reasons. One common cause is signal pickup by the shield of the feed line. A balun at the feed point eliminates the problem, but typical sleeve baluns, called "bazookas," are frequency-sensitive and their dimensions are critical at UHF.

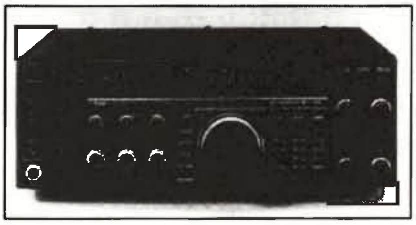
I solved a pesky sidelobe problem on this quad by using ferrite beads as a choke balun. It takes two dozen beads (4-1/2 inch balun) to insure that all outside shield RF currents are attenuated to insignificant levels. You can use this trick on any VHF or UHF beam, but be sure to pick the right ferrite material.

At 2 meters, #43 beads (part number FB-43-2401) are optimum. That mix is usable from 6 meters well into the UHF range. A better material for use above 400 MHz would be #64, but #64 beads of this size are not available.

Cut the coax jacket back and slip the beads over the shield braid before installing the end connector. The inner diameter of the beads (0.197 inch) is too small to put them over the jacket. Put tape or shrink sleeving over the whole balun if you like, but don't worry about shorting anything with the beads. Ferrites for these frequencies are non-conductive.

My source for beads is Amidon Associates, PO Box 956, Torrance CA 90508; (310) 763-5770. The cost is $4.50 per dozen or $16 per hundred. There is no minimum order quantity, but Amidon charges at least $4 per order for shipping and handling. 73





Number 16 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Monster ATV Rockets

Just north of Edwards Air Force Base in the Mojave Desert, I cruised along the edge of a large dry lake bed. At the end of a little-travelled dirt road, I drove past the liquid fuel rocket engine test stand and parked next to a Quonset hut where a number of folks were assembling the solid fuel rocket.

A NASA experiment in progress? Nope . . . I had just arrived at the "Missile Test Area" for the Reaction Research Society. This group consists of a number of experimental rocketeers who meet periodically in the desert to test out their new creations. We're definitely not talking about your typical hobby store variety of model rocket—some of their rockets are what I would consider full-scale!

The ATV Rocket

Inside the Quonset hut, Bruce Markle of San Diego was busy assembling his 6-foot-tall solid-fuel rocket. Bruce's rocket had a very intriguing tail-fin assembly. To stabilize the rocket from rolling during the flight, he had "rollerons" mounted in two of the fins. Similar to the devices used in Sidewinder missiles, each rolleron consisted of a 2-3/4" milling wheel (available from machine tool shops) which was mounted vertically within a hinged surface in two of the tail fins. The edge of each wheel is grooved in much the same way as a water wheel. This allowed Bruce to spin up each rolleron with compressed air to several thousand RPM before liftoff. In addition, the rollerons would continue spinning as the rocket flew through the air at high speeds. During flight, if the rocket attempted to roll, the rolleron-fitted fin would compensate due to gyroscopic action.

In addition, Bruce could move the other two fins (acting as one surface) via R/C control to actually steer the rocket during the flight.

Since Bruce's rocket was over 4" in diameter with a large payload compartment, and since it was so incredibly stable, it seemed to be the logical vehicle for some live ATV experiments!

Mike Henkoski KC6CCC teamed up with Bruce and built a very compact 6-watt ATV transmitter/camera package designed to fit snugly within the rocket. The payload consisted of a PC Electronics ATVM-70 micro-ATV transmitter (see the July '91 issue of *73*, page 9), a 6-watt amplifier brick and a miniature B/W TV camera (similar to the Micro Video Products CX-102 or the GBC CCD-100). Mike mounted everything in a Bud box and PC board material reinforced with brass strips. Mike's package was so well made, it looked like you could drive a truck over it with no ill effects!

Just outside of the camera porthole, a small mirror was epoxied in place to direct the camera view towards the ground to see the spectacular lifoff. Right above the mirror, a half-wave dipole was mounted for the 434 MHz ATV downlink. The "V" shape of the dipole helped make it more aerodynamic and also improved the impedance match.

A Spectacular Liftoff

Just prior to liftoff, two jets of compressed air spun up the rollerons to several thousand RPM. As we all kept our distance, the fire command was issued and, in an impressive display of smoke and flame, the rocket raced for the sky. Inside the hut, we could all ride along with the rocket by watching the ATV downlink. With the high-power ATV transmitter we received absolutely P-5 snow-free images throughout the flight. The rocket made it up to about 1200 feet in just a few seconds. The rollerons worked amazingly well, absolutely NO spinning was observed in the video downlink, just a beautifully stable view of the desert floor disappearing below.

Splat!

As the parachute ejected, disaster struck! The elastic shock chord con-

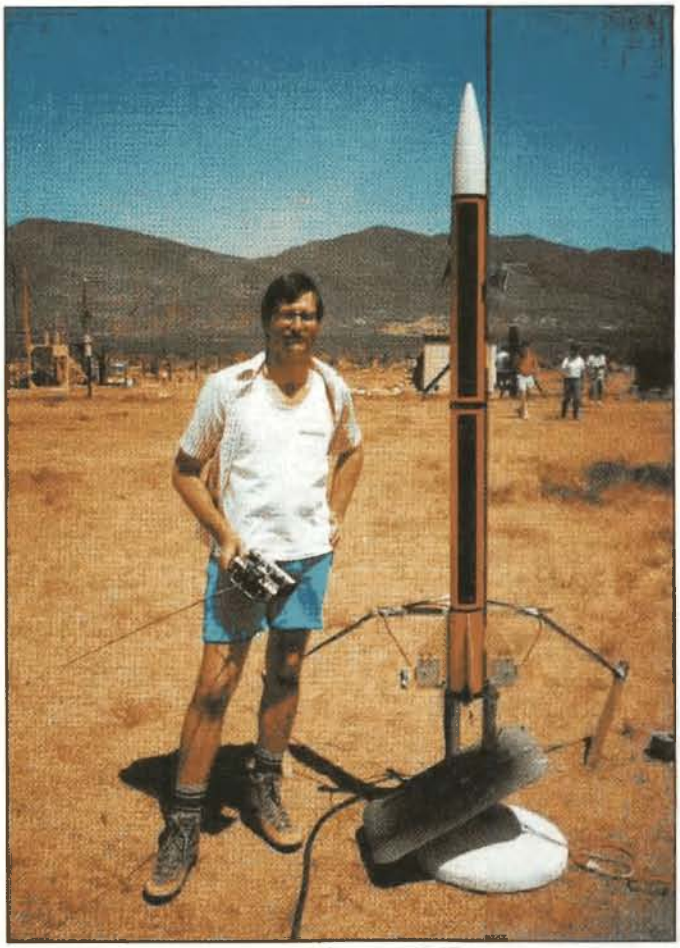


Photo A. Bruce Markle readies his R/C-controlled, ATV model rocket for flight.

Photo B. Liftoff of the ATV rocket.

Photo C. The "landing." The ATV package miraculously survives the impact amidst the remains of the rocket.

Photo D. Mike Henkoski KC6CCC (designer of the ATV package) pulls the ATV payload out of the rubble and is amazed to find it in perfect working order!

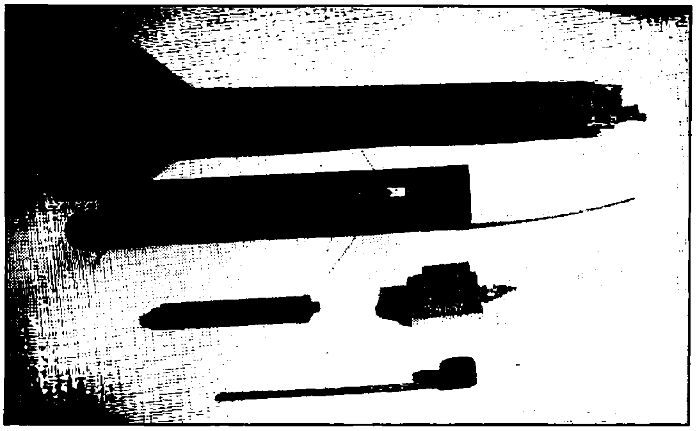


Photo E. Individual rocket sections. The ATV package (shown in the foreground next to the rocket engine) was mounted just below the nose cone section.

necting the parachute to the body of the rocket snapped in two and the rocket (with ATV payload) plummeted rapidly to the ground below. We all watched in stunned silence as the rocket hit the ground with a sickening "whump" just 100 feet from the hut.

As the dust settled, all that remained of the rocket was the tail-fin assembly and a large pile of twisted

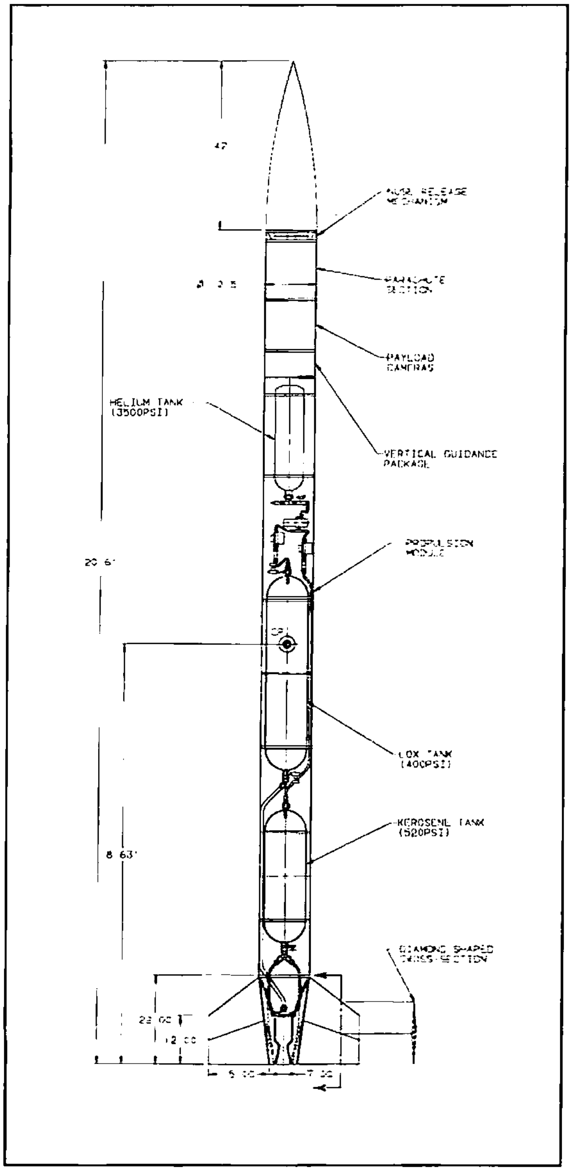


Figure 1. Diagram of David Crisalli's liquid fuel rocket which will take ATV to over 200,000 feet this fall.

Photo F. Close-up view of the small mirror which directed the camera view towards the ground. The ATV transmit antenna consisted of an inverted-V style dipole located just above the mirror.

rubble. We all wondered if any recognizable pieces of the ATV payload could be found. After digging around a bit, we found a few shards of electronic components: a bit of a resistor, a partial capacitor and a couple of rubber buttons. It turned out to be all that was left of a Radio Shack timer. At the bottom of the pile we were astonished to find the slightly bent, but completely intact ATV package. We were even more amazed when Mike KC6CCC applied power to the transmitter and we were treated with a perfect picture. It takes a REAL licking and keeps on ticking! We estimated that the rocket had hit the ground going over 150 mph and produced over 1000 Gs on the package during the impact.

Future Flights

Bruce Markle's rocket was a scale model of a liquid-fueled rocket that David Crisalli is currently building. In fact, this flight was a test to see how the guidance system and the ATV payload performed in order to prepare for the mega-flight later this fall.

David Crisalli's liquid fuel rocket will stand just under 20 feet high, will be 12.5" in diameter, and will weigh in at 380 pounds (see Figure 1). Using a mixture of kerosene and liquid oxygen, the engine can produce 1,000 pounds of thrust for upwards of 45 seconds. David hopes to reach a top altitude of over 200,000 feet with this flight (currently scheduled for early fall). He is hoping to gain permission to fly out of the White Sands, New Mexico, area.

This rocket will have a fairly large payload area. Current plans are to fly the 6-watt ATV package with a B/W camera (and possibly a color camcorder) and a 2 meter telemetry downlink. The line-of-sight range at this altitude will exceed 550 miles. David has room for some additional payloads and would be happy to fly other packages as space permits.

This flight should provide us with some very spectacular ATV footage during its trip to the very edge of space.

Join in the Fun

If you would like more information about the Reaction Research Society's activities, you can write to them at the following address (they also offer a newsletter): Reaction Research Society, P.O. Box 90306, World Way Postal Center, Los Angeles CA 90009. For more information about the liquid fuel rocket you can contact David Crisalli, 3439 Hamlin Ave, Simi Valley CA 93063. To learn more about the scale model version shown in this column you can write to Bruce Markle, 5944 Portobelo Court, San Diego CA 92124.

For those of you interested in building large rockets, there is a publication called "High-Power Rocketry" put out by the Tripoli Rocketry Association, Inc., P.O. Box 40475, St. Petersburg FL 37743-0475.

UPDATES

Number 30 on your Feedback card

8,000 Channels for the Ramsey FX-146

See the above article in the June '92 issue of *73*, page 10. Although the PC board foil pattern and the parts placement diagram are correct as shown, the schematic diagram (Figure 1) has three errors. The "+RPT" and the "-RPT" lines are reversed in the schematic and the value of the capacitor attached to the Vcc lead on the bottom EPROM should be changed from a 0.1 μF value to 10 μF. In addition, the program to determine the EPROM frequency select data is missing the "divide by" symbols in lines 70 and 90. Also, the values in lines 100, 110 and 120 have been changed in the new version. See the figure for the correct program. This program is also available from the *73 BBS* at (603) 924-9343 under the filename "FX146MOD.BAS." *Cecil A. Moore KG7BK*

Ask Kaboom

In the June '92 "Ask Kaboom" column the following sentence was inadvertantly changed: *"Instead of sending the same byte over and over, the delta modulator simply sends it once: analog with a code telling the demodulator how many times it is to repeat."* The sentence should read: *"Instead of sending the same byte over and over, the delta modulator simply sends it once, along with a code telling the demodulator how many times it is to repeat."*

Michael Geler KB1UM

The BASIC program for obtaining the HEX address and HEX memory contents for the two EPROMs is listed below:

```
10 FOR N% = 7000 TO 9000
20 F = (20*N%)
30 FF=(F-140000!)/10:FFF%=FF
40 UFF%=FFF% MOD 10:FFF%=FFF%\10
50 TFF%=FFF% MOD 10:FFF%=FFF%\10
60 HFF%=FFF% MOD 10:FFF%=FFF%\10
70 ADR%=UFF%\2+TFF%*8+HFF%*128+FFF%*2048
80 PLDATA%=N% MOD 256
90 PHDATA%=N%\256
100 IF F>=145100! THEN IF F<145500! THEN PHDATA%=PHDATA%+128
110 IF F>=146600! THEN IF F<147000! THEN PHDATA%=PHDATA%+128
120 IF F>=147000! THEN IF F<147400! THEN PHDATA%=PHDATA%+64
130 PRINT "FREQ", "NUMBER", "PROM ADR", "HIGH BYTE", "LOW BYTE"
140 PRINT F,N%*4,HEX$(ADR%)"H",HEX$(PHDATA%)"H",HEX$(PLDATA%)"H":PRINT
150 IF INKEY$="" THEN GOTO 150
160 NEXT N%
170 END
```

Figure. The updated program to determine EPROM frequency select data for the RAMSEY FX-146 modification.

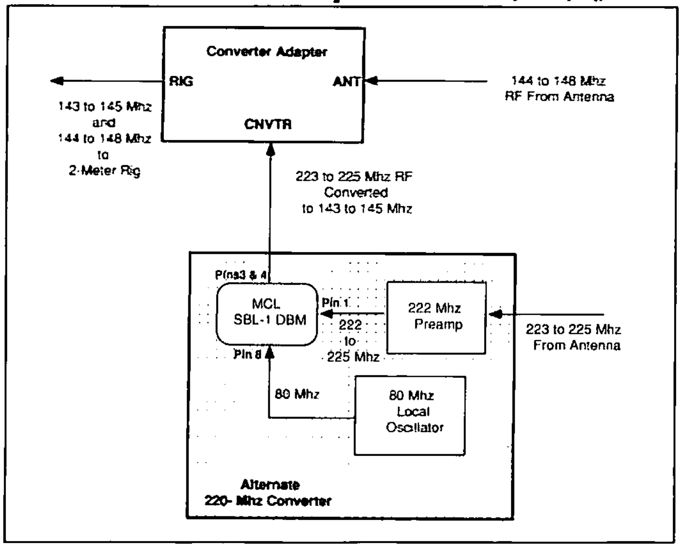


Figure 6. An alternative circuit for the 220 MHz converter using an 80 MHz local oscillator.

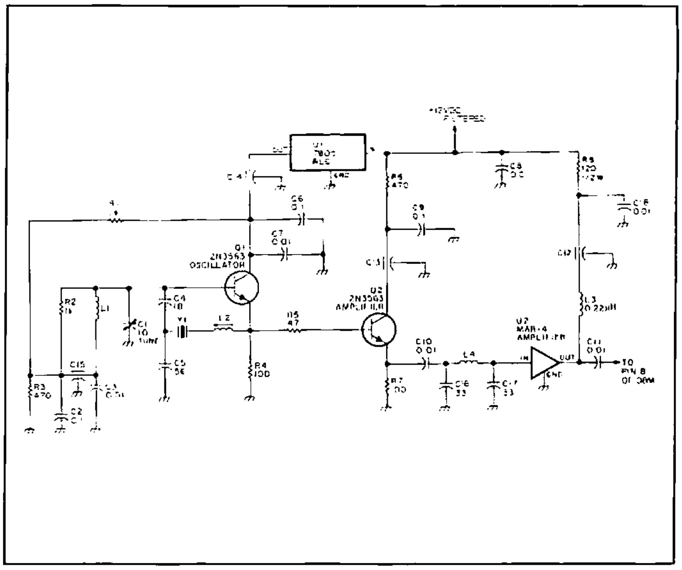


Figure 7. Schematic diagram of the local oscillator.

tally and L2 is mounted vertically in Figure 8A—though this could be reversed if you adjust the spacing and positioning of the mounting pads. The completed oscillator, preamp and mixer can be mounted in the same chassis with the Receive Converter Adapter or in a separate housing. I use threaded stand-offs to mount the modules in their enclosure.

Coax Section Trimming with a Grid-Dip Oscillator (GDO)

A Grid-Dip Oscillator (GDO), or solid-state equivalent, can be used to fine-tune the quarter- and half-wave coax sections. (Remember when most electronic devices had grids?) The first step is to create a small loop between the coax center conductor and shield at one end of the coax. Leave the other end of the coax open. Using a GDO coil selected to cover a range lower than the expected frequency, couple to the coax section loop and tune the GDO for a dip to indicate the resonant frequency of the line—moving higher in frequency until a dip is found. This is important in finding the true resonant frequency and avoiding false peaks. Trim the line by small cuts to obtain the desired resonant frequency. The same procedure can be used if you want to use the half-wave coax section, but the dip indicted will be at half the desired frequency. As an example, a properly trimmed half-wave coax section at 147 MHz will present a "dip" to the GDO at 147/2, or 73.5 MHz.

Checkout

With everything connected to the proper connectors on the converter adapter, start with your transceiver in the low power position. (It is important that the converter or another 50 ohm load is connected to the converter port during receive to minimize losses due to the reduction in signal which would result from the unterminated quarter-wave section of coax π2.) If possible, perform the initial checkout with a 50 ohm load to minimize the effects of an antenna SWR. Leaving the low-pass filter out during checkout may also be helpful. Transmit operation should be normal, with minimal differences noted from operation with the converter adapter out of the line to the antenna or dummy load. If abnormal operation such as reduced power out is indicated, check for correct converter adapter cable connections and check for coax section shorts. That's all there is to it!

Operational Considerations

Power capability: The converter adapter has been used with transmitter outputs up to the 40-45 watts level. The RG-59/U cable can handle this power with no problem and the diodes have stood up well. At the other extreme, even operation at 100 mW should provide enough RF at the diodes to cause them to operate properly in this circuit.

Receive converter protection: Diodes D1 and D2 provide protection to the receive converter during transmit. Even with the diodes conducting, some RF is present at the converter port. Rough measurements with an RF probe-VTVM combination have shown the RF level to be over 1 volt. This should not bother the output of most converters, especially not the DBM types described, but it is something to be aware of before trying this approach.

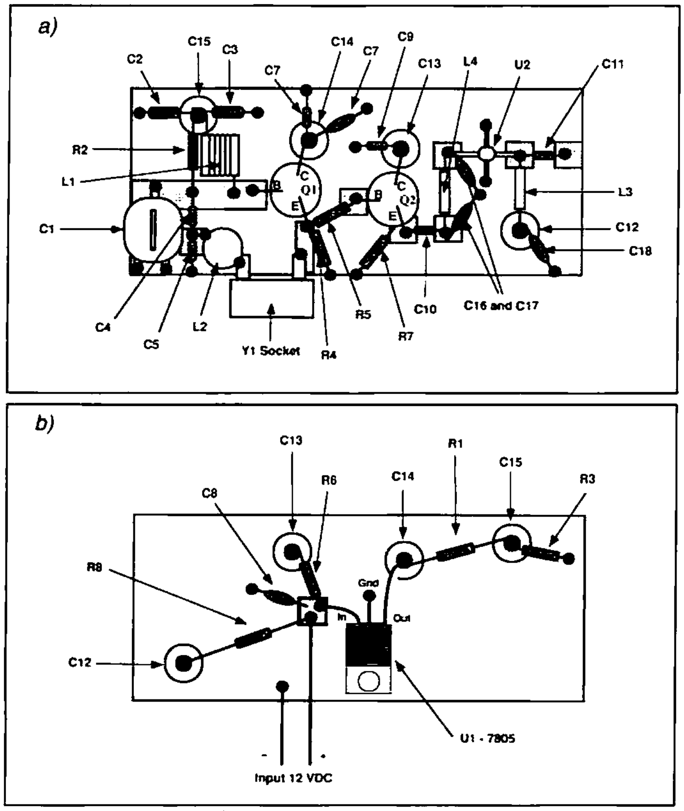


Figure 8 (a). Front side parts placement for the local oscillator. (b). Reverse side parts placement.

Parts List

C1	10 pF ceramic trimmer or equivalent
C2, C6	0.1 μF disc ceramic capacitor, 16-20 volts
C3, C7, C8, C9, C10, C11	0.01 μF disc ceramic capacitor, 16-20 volts
C4	18 pF NPO ceramic capacitor, 16-20 volts
C5	56 pF NPO ceramic capacitor, 16-20 volts
C12, C13, C14, C15	0.001 μF feedthrough bypass capacitor, 16-20 volts
L1	5 turns no. 28 enameled wire, 0.1" I.d., 0.2" long
L2	8 turns no. 28 enameled wire, 0.1" i.d., 0.2" long on a slug-tuned form.
L3	0.22 to 1.6 μH miniature RF choke
L4	0.10 μH miniature RF choke
R1, R2	1,000 ohm 1/4 watt carbon film resistor
R3, R6	470 ohm 1/4 watt carbon film resistor
R4, R7	100 ohm 1/4 watt carbon film resistor
R5	47 ohm 1/4 watt carbon film resistor
R8	120 ohm 1/2 watt carbon film resistor
Q1, Q2	2N3563 NPN transistor or equivalent
U1	7805 or equivalent 5-volt regulator
U2	Mini-Circuits Lab MAR-4 MMIC amplifier
Y1	5th overtone, series-resonant crystal 90 MHz, 77 MHz, or 80 MHz (see text)
DBM	SBL-1 double-balanced mixer (Mini-Circuits Labs)

CIRCUITS

Number 17 on your Feedback card

Great Ideas From Our Readers

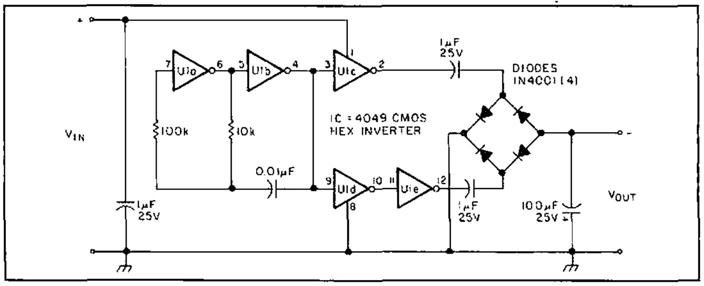


Figure 1.

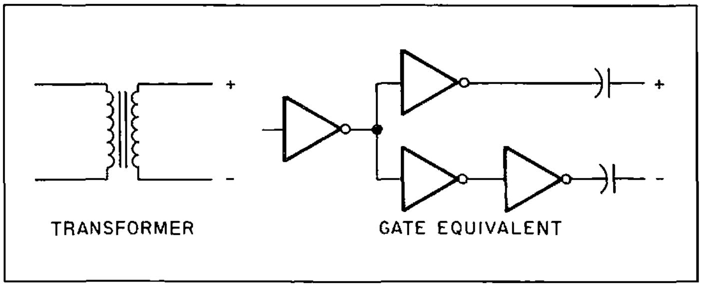


Figure 2.

Inverting Power Supply

How many times have you needed a low-current negative voltage for that op amp or RS-232 circuit? Figure 1 is a circuit I came up with to do the job. I used a 4049 CMOS hex inverter in this application since this IC is capable of more output current than the typical CMOS IC.

U1A and U1B form a standard CMOS oscillator. With the R/C values shown, the unit oscillates at 4200 Hz. U1C and U1D buffer the output of the oscillator, and U1E inverts the output to the diode bridge with respect to the output of U1C. The outputs of U1C and U1E are AC coupled to the diode bridge, then full-wave rectifies the AC signal and gives you the final negative voltage output.

Figure 2 shows how you can make a transformer equivalent circuit out of some gates. In both cases you are AC coupled. And in both cases the outputs are 180 degrees out of phase with each other.

This circuit works well with low currents. With no load, the negative output is within 0.6 volts of the positive input. With 10 milliamps of load current, the negative output will be about 3 volts less than the positive input. The output is completely ripple-free with the 100 uF filter capacitor shown. Of course, at the 4200 Hz frequency the capacitor is almost equivalent to a 10,000 uF capacitor at 60 Hz.

Depending on current drain, this circuit is useful from 5 to 15 volts. Don't apply more than 15 volts input as you'll exceed the voltage rating of the 4049!

Phil Salas AD5X
Richardson TX

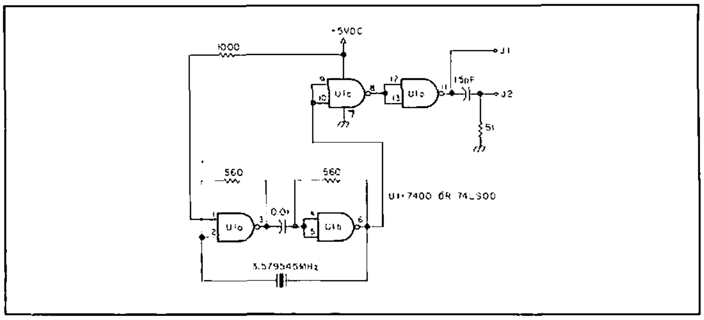


Figure 3. Wide-range crystal oscillator.

Wide-Range Crystal Oscillator for Receiver Sensitivity Testing

Here's a simple single-chip crystal oscillator which can use any crystal between 1 and 13 MHz and will produce very strong harmonics. When a color-burst crystal (3.579545 MHz) is installed, it will produce strong harmonics in or very near every HF band from 80 through 10 meters. These produce *known* "on-the-air" signals ideal for checking receiver sensitivity, noting the S-meter indication. If sensitivity is checked every six months any deviation will be readily evident, a warning that something in the RF path has deteriorated and should be investigated to maintain sensitivity within the manufacturer's specifications.

The crystal will oscillate in its series resonant mode in this circuit, a bit higher in frequency than that marked on the crystal. As an indication of the result to be expected, harmonics *calculated* from the marked frequency of the crystal, and the distance outside those ham bands not in exact harmonic relationship to the crystal fundamental frequency, are listed below, rounded off to the nearest kilohertz.

Whether the harmonic is in or slightly out of the band, sensitivity of the receiver will be the same because none of the out-of-band harmonics are more than a few parts per million from the nearest band edge. This is a very small percentage, even in the worst case condition of 30 meters where the third harmonic is 0.059% high.

No direct connection to the receiver is required. If desired, the output can be connected through a step attenuator of 50 ohms impedance to the receiver antenna connector. However, unless this oscillator is completely shielded it will radiate strong harmonics to the station antenna.

As an example, feeding the output directly to the antenna connector on my Kenwood TS-440S/AT, the 8th harmonic on 10 meters registered S9 + 40 dB. Radiated about 50 feet to the nearest end of my 40 meter dipole, the 10 meter harmonic registered a little over S9.

Either a 7400 or 74LS00 chip can be used. There is approximately 3V peak-to-peak square wave riding on +1 VDC at J1. J2 provides a differentiated square wave—positive and negative pulses containing all harmonics—of about 0.25V peak-to-peak at 50 ohms impedance. A short "antenna" can be connected to J1 if desired to radiate the harmonics to your antenna.

All parts are available from Radio Shack as well as from most mail order parts dealers. The resistors are 1/4W, 5%; the capacitors are disc ceramic. The total cost will not exceed $3.00, including the color burst crystal.

J. Frank Brumbaugh KB4ZGC
Bradenton FL

Band	Frequency	Deviation
80	3.580	
40	7.160	
30	10.740	590 kHz high
20	14.320	
17	17.900	168 kHz low
15	21.480	30 kHz high
12	25.060	61 kHz high
10	28.640	

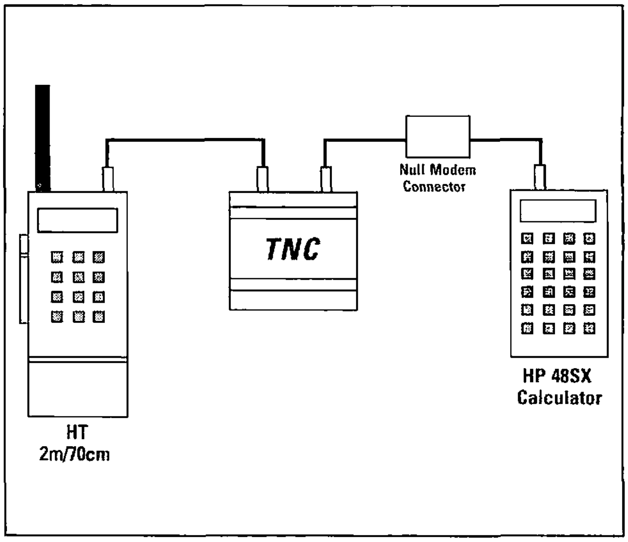


Figure 4.

Hand-Held Packet Station

This is one method of putting the HP48SX calculator to good use in the world of ham radio.

Here is the configuration I used for my packet station on Field Day, 22 June 1991. The HP48SX calculator runs a terminal emulation program, and is connected via its serial port to a TNC at 9600 baud. The HP48SX uses three "triple A" batteries, and I'm still using the batteries that came with the calculator (November 1990). The HP48SX has a 64 x 131 pixel display, and does quite well at displaying the data.

There are easier ways to enjoy packet radio, but I think this is the first time it has been done with a calculator.

It is fun, different, and very portable.

John Bachelor N8LIJ
Columbus OH

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

PMTs and Lasers

Now that you have PUFF well under your belt from the previous columns, I hope you have as much fun with it as I have had. Writing explanations helped me better understand PUFF and become more familiar with its commands, and I hope that covering it in this way will remove any start-up difficulties you might encounter. PUFF is a very complex program and there are still many different applications that need to be further explored. The booklet that comes with it gives examples of those applications, and in future columns I will cover some of these other aspects. If you come up with any interesting applications please drop me a note describing them and I will be glad to share them in this column. I am sure that some questions will surface regarding PUFF operation and I will try to cover them in the column as they come up.

Laser Operation

This month I would like to describe some new developments concerning laser operation. Quite some time ago I was involved in the construction of a system using HeNe (Helium-Neon) for a laser communication system. This was primarily due to the large number of HeNe laser tubes becoming available on the surplus market at low prices. In addition to the HeNe laser, I acquired quite a few different types of detectors for evaluation in our system receiver. I tried some very expensive solid-state pin photodetectors and the good old surplus photomultiplier tubes. Not being optics-savvy at first, I was surprised that the photomultipliers showed the highest system gains. Being an amateur, I first naturally selected the (PMT) photomultiplier for use in our top-end receiver. Its surplus cost was low.

Several amateurs helped me obtain different PMTs for test evaluation. There were various types, with all different sensiometric sensitivities. Specific PMTs are sensitive to different frequencies of light. It is very difficult to get a PMT with peak sensitivity to our laser (HeNe), which peaks at 632.8 nanometers, or 6328 angstroms, the frequency of red light. Most PMTs' sensitivity to the frequency gave about 10 to 20 percent efficiency. Even at this low percentage, operation sensitivity was remarkably high.

A little perspective on laser transmitters and receivers might be in order. The detector in a laser system can be a pin diode or a (PMT) photomultiplier. These two types are very sensitive. A solar cell could be used, but it gives poor sensitivity in contrast to the pin diode or the PMT. This detector is used to detect the laser beam and recover the modulation that is impressed on the beam. There will be no output listening to a laser beam that is continuous (CW) mode.

The laser beam must be modulated for the detector to recover intelligence. Normally, a laser is modulated by a simple 12-volt muffin fan such as is found in many of the IBM type computer power supplies. This DC fan is mounted in such a way that the continuous beam from the laser is passed through the rotating blades of the fan. The rate with which the fan blades "chop" the laser beam is the same audio rate that is transmitted. Code is transmitted by use of a shutter or your hand forming CW code on the beam's modulated rate (three long openings of the shutter and you have sent the letter "O").

This modulation rate (1 kHz) is easily detected and amplified by low frequency audio amplifiers. The prime key to success in this amplifier is the first stage. The amplifier should have high gain and very good low frequency noise response (that's a good low noise audio transistor). Additionally, it should have some form of feedback in the stage that maximizes gain at the audio frequency of interest. This feedback circuit prevents gain at other frequencies and accentuates the frequency of interest about 1 kHz, providing maximum gain there. See this column in the May, June and July 1991 issues of *73 Amateur Radio Today* for more on the laser topics and on power supply construction in general.

Power Supply

Let's get into some application details for a proposed low current power supply driver that can power PMT s. When the circuit is fully developed I will cover final test results for evaluation.

A new power supply system might not seem very important, even for portable photomultiplier tubes. However, battery conservation is quite important when operating from field locations. We not only reduce the weight of extra batteries but most likely increase the time we can operate from our existing battery. The problem with PMT tubes is that they require a high-voltage source of 1,000 to 1,250 volts DC distributed through a voltage divider made up of resistors across the dynodes (tube elements). This voltage divider traditionally was constructed with 100k to 470k ohm resistors in a series string of 10 or more resistors (see Figure 3). The actual number of resistors used depends on the number of tube elements (dynodes) for your particular PMT.

With a high voltage supply of 1,250 volts DC this usually means a current requirement of several milliamperes (0.001 to 0.003 mA) flowing through the network. Most of the current is used up in the resistor network as the tube current requirement is nil, or microamperes (almost nothing). Now, at first glance this doesn't seem like much but consider that 3 mA at 1,250 volts DC is almost 4 watts of power. Quite a bit, with almost 90 percent of it going to nothing more than heating the resistor string.

Enter the Cockroft Walton circuit to solve this power-hogging problem. The circuit is basically a voltage doubler that is stacked on end in an arrangement of capacitors and diodes. It has seen use in laser power supplies, multiplying its 1,500 to 2,000 volts (necessary to sustain a HeNe laser) to a starting voltage of around 10 Kv to ionize (start/ignite) a laser. See Figure 1, the laser starting circuit. This circuit can be adapted to the photomultiplier tube because the tube does not draw an appreciable amount of current from the multiplier assembly. (This multiplier arrangement cannot support much current demand from the PMT load.)

This is where the two circuits, laser and photomultiplier, differ. The laser requires a 10 kV high starting voltage to ionize the gas in the HeNe laser tube and when it ignites it draws a large amount of current: 5 to 30 mA, depending on the tube type. The starting circuit disconnects on high current at this point. It's still there but, due to the small value of the capacitors used, it cannot maintain the multiplication operation. The diodes are still in the circuit but are now just series pass elements and are, for the most part, invisible.

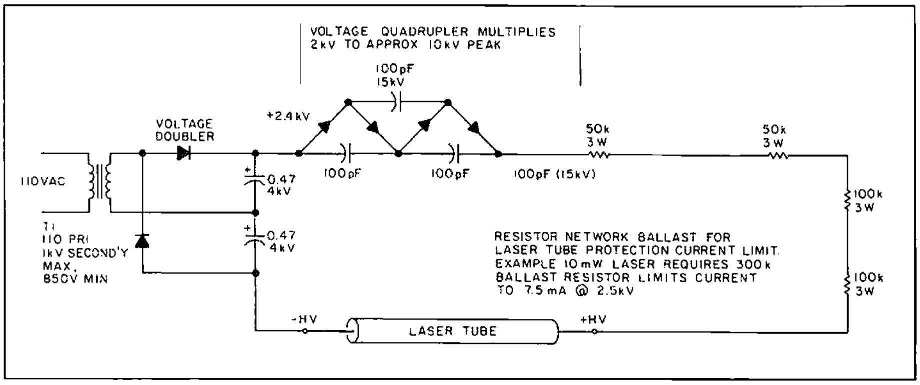


Figure 1. Laser power supply starting circuit.

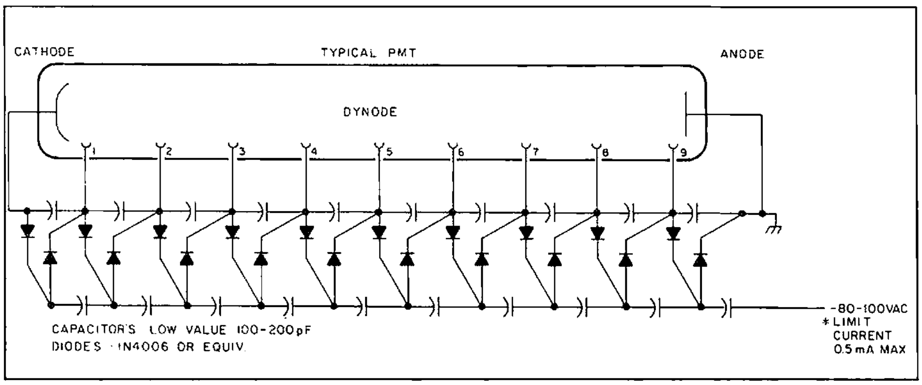


Figure 2. New PMT power supply drive circuit.

With a photomultiplier tube the current requirements are very minimal, near static values, so the multiplier approach can be tried. I haven't had time to construct a full working model of this method but I thought you might like to see what it's all about. See Figure 2 for the circuit details. Notably, the circuit is an extension of the circuit shown in Figure 1. The resistors have been eliminated and a large capacitor diode network is used in their place. The beauty of this circuit is that power dissipation is minimal and it can be constructed using low voltage components, in contrast to the high voltage components used in the laser power supply (there you must use components in the 5 to 10 kV range). In the new circuit, low voltage diodes and capacitors with low PIV voltage can be used. This makes construction right out of the junk box quite practical and inexpensive compared to a conventional high voltage power supply.

The values I would select for a first test could be 1N4006 or similar, with a 600 PIV rating (overkill on my part). The capacitors can be anything handy, from 100 to 200 pF or so. I plan to use 100 pF capacitors as I have a large quantity of disc ceramic 1 kV types on hand. Matter of fact, if you need capacitors, I will be glad to mail you a handful for postage costs, about $2. The power supply multiplier circuit is driven from a stepped-up AC source. This is where I plan to construct a simple switching driver, possibly a 555 driving a transistor pair with a small toroid transformer stepping up voltage from 12 volts DC to about 40 to 80 volts AC to drive the multiplier. Current limiting must be used between the multiplier and power supply to prevent the tube from trying to draw abnormally high current from the diode stack, unlike the old resistor type circuit which is naturally inhibited. The total current should be kept below 1/2 mA.

As I get more time I will present the final circuit as it develops. I am very anxious to use something like this for portable PMTs. In past laser systems, the PMT power supply gobbled as much of the battery consumption as did the laser (6 watts at 12 volts = 1/2 amp battery current for the PMT). This circuit promises to decrease battery drain, making portable operation on batteries easier. I apologize for not fully developing the circuit right now—I have many other microwave operation projects in the works right now, like getting ready for Field Day and the 10 GHz ARRL contest weekends in September/August.

Column Credits

There are many different people that help with ideas and suggestions, not to mention some of them lending me their circuits to publish. I could not do this work without their help. I also have to rely on many members of the San Diego Microwave Group to furnish ideas and methods, circuits and such to present here. I could not do this column without them, or without

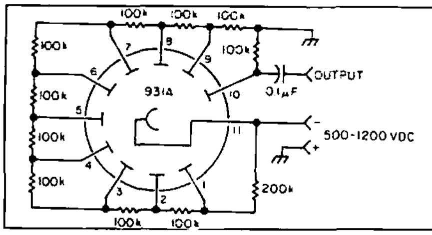


Figure 3. Typical surplus 931 PMT.

you for that matter. All contributions are appreciated.

Good Surplus Supplier

For your information, I discovered a good supplier of surplus material called Halted Specialties (3500 Ryder St., Santa Clara CA 95051; phone (800) 442-5833 to order). They specialize in surplus materials and are putting together a new catalog. At present they have a 2 mW HeNe laser tube for $15, and a 24-volt input supply available to power the HeNe's for about $40. Also available are 12-volt power supplies, but they are more expensive. I thought you might be able to find something you are looking for as materials can be hard to obtain sometimes. I just ordered some material from them and their service was very prompt—I received the material in three days via UPS.

New Projects

Let me know what you are working on and I will be glad to make it part of the column. As far as new items are concerned, I should be receiving a 5.6 GHz mixer circuit in the mail soon and I plan to construct several PC boards for development. I'll publish the artwork in this column when tests are complete on the mixer. Kerry N6IZW is working on a frequency synthesizer with a quite novel approach. It can be adapted to stabilize almost anything, even a HP-608 Hewlett Packard signal generator. The heart of the system is a microprocessor that measures the period of input signal and uses this period to stabilize the circuit. I am watching the development and it's quite an interesting circuit. Also, we built a stabilizer for the phase-locked brick type oscillators and will present that in an upcoming column.

Mail Box

Roy Wilmer K7YWF writes that he has been active since 1959, mainly on the VHF bands and that I, through this column, have got his interest up in exploring the microwave bands. He has been gathering parts and pieces. Recently Roy received a commercial wideband FM transmitter and receiver for 4.7 GHz. This equipment was all solid-state, with a Fairchild brick oscillator in the receiver. Roy is currently looking at the possibilities of making modifications to the equipment to put it on the 5.6 GHz microwave band.

In his junk box Roy also has two Ma-Com Gunnplexers™ for use in mountain-topping on 10 GHz microwave as soon as IF systems can be constructed for these units. Roy is looking forward to mountain-topping in the Utah/Las Vegas area.

The IF board Roy plans to construct is based on the TDA-7000 design I presented from Signetics. However, I am having trouble getting a source of new chips as my distributor and his factory are out of stock at present. *[Ed Note: The TDA-7000 chip is currently available from DC Electronics, P.O. Box 3203, Scottsdale AZ 85271; (800) 423-0070 or (602) 945-7736.]* If this persists I will redesign the board and use a Motorola chip that is a lot easier to obtain, the MC-3357. This chip is quite similar to the "TDA-7000" in operation but has several unique features. It is made to operate as a 10.7 MHz IF system, making a converter ahead of it necessary. By the way, many different HTs use this chip, including some of ICOM's products.

Fred Spinner KA9VAW of Terre Haute, Indiana, writes that he is much closer to graduating (in electronics). He is having quite a time experimenting with MMIC amplifiers, and states that they're great. He included some information on WEFAX picture format information for 1691 MHz. The specs are as follows: modulation FM, deviation +/- 9 kHz; ground signal level, -134 dB; video mode, APT (automatic picture transmission); video subcarrier, 2400 Hz; video modulation, AM; line rate, 4 Hz or 240 lines/minute; scan left to right, top to bottom.

Fred inquired about my WEFAX system, which is not active at present. I constructed a system using an 8-foot dish and appropriate feed, coupled to a surplus amplifier that gave about 35 dB gain and had a 2 dB noise figure. I used a friend's 137 MHz receiver for downconverting and the lash up, while not really permanent, did work. It would take additional effort to mount the dish permanently focused, but my wife objects to it so it came down after the test. Right now I am copying the WEFAX charts from a re-transmission station in the Stockton, California, area on 6.453 MHz. Signal strength is quite good and the charts are also very good quality. Once in awhile (daily) they re-transmit actual satellite pictures, and on a VGA monitor they're very good. At other times they broadcast surface analysis, sea temps, and satellite imagery. Great stuff! Besides, you don't need to have a dish in the yard. Note: A good low-noise preamp for the 1691 comes from the innards of a junked Ku band "LNB."

Glenn Baumgartner KAØESA from Springfield, Virginia, is planning to construct a stable beacon from a Frequency West brick, using it as a "set-and-forget" source for a beacon. He is planning to set it near the 10.265 MHz frequency, halfway between the standard wideband FM frequencies of 10.280 and 10.250 MHz.

Ralph Herzler WA8WBP acquired a couple of Solfan wideband FM alarm units and wants to know how to bring them down to the ham bands. Of the two units he has, one draws normal current (about 150 mA) and will set off radar detectors when activated. The other just draws current and does not appear to function, compared to the first unit. Additionally, the units have an RC network tied to the receive diode to receive wideband FM with some kind of FM strip. Should this network be removed, how is the connection made to the receiver? What diodes are suitable for receiving?

Well Ralph, let's take the questions one at a time. First frequency adjustment of the cavity. The tuning screw is lowered into the cavity about three turns to bring typical units from their normal frequency of 10.525 MHz to something near 10.250 MHz. This screw (10/32) is fixed on top of the cavity with a lock nut. Looking inside the cavity (with the unit off), its pointed screw is in the middle of the cavity. Removing the screw from the cavity increases frequency. You need a wavemeter or frequency counter to set frequency accurately.

An alternative method is to find someone who is known to be on frequency and set up a work bench test adjustment. With an IF of 30 MHz you will be either high or low by 30 MHz, but in the band and operational. Concerning the defective unit: If current is in the normal range (140 mA) for a 10 mW power device, the trouble could lie in adjustment of the iris screw (cavity opening, 4/40 screw and lock nut). Don't confuse this screw with the 4/40 screw on the horn antenna. The iris screw is the other one (not on the horn antenna).

The Solfan units came with a combination RC network on the detector diode (1N23 type), and this should be removed. Leave the RFC if it's still there as it provides a DC return for diode current. If you do not have an RFC on the diode to ground, you will suffer from poor sensitivity. Diode current is adjusted for something near 1/2 to 1 mA, as measured from diode to ground (in series with RFC). The diode (1N23) 10 GHz device is coupled out with a small value capacitor to any preamp or converter input of 0.001 μF or less. The 1N23 devices look just like 1N21 devices (same package). However, 1N21 devices are only rated for 6 GHz (6,000 MHz). I have trouble with that statement as to me it should be CYCLES, not HERTZ. It's the same trouble with the metric system, but then we all have lots of rethinking to do.

Well that's it for this month. As always I will be glad to answer questions on VHF and related subjects, for a prompt reply please enclose an SASE. 73 Chuck WB6IGP.

Indoor or Window-Mounted Dipole *Continued from page 12*

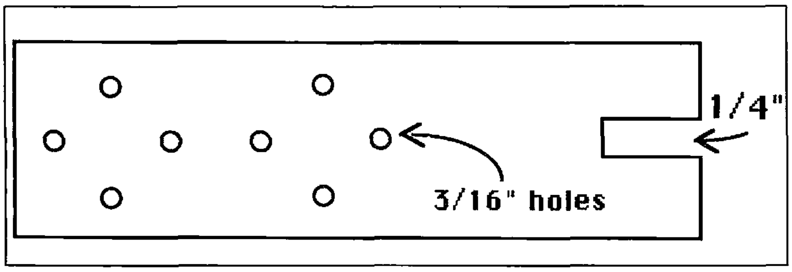


Figure 2. Approximate locations of the bracket mounting holes and the slot for the C-clamp in the mounting board.

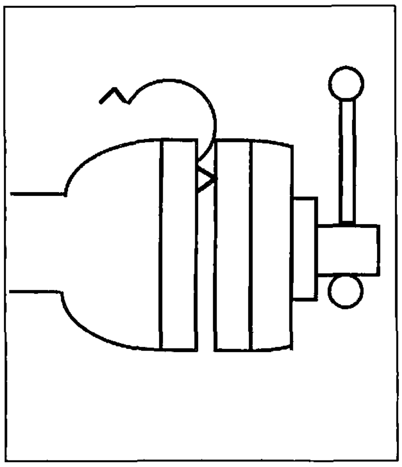


Figure 3. Using a vise to flatten the edges of a flagpole bracket to make the end half-ring a little larger so that the spring will fit in.

mount. However, the type of clamp shown in the photos will rust if it is left outdoors.

The element with the center insulator, coax connector, and spring attached to it should be inserted into the bracket pointing upwards, not as shown in Photo G. The spring will fit into the bracket more securely if you open up the outer end of the bracket a bit wider so that the spring fits inside it. This can be done by flattening the side of the bracket in a vise, as shown in Figure 3.

The two mounting brackets must be connected together. Use a short wire with ring terminals that fit over the mounting bolts for the brackets.

Safety

Never operate the antenna so that anyone could come in contact with it. Shocks and RF burns are a real possibility with an indoor antenna. Also give attention to hazards of electromagnetic radiation from this antenna, and place it as far as possible from you, your family, and your neighbors. *[Ed. Note: Use the minimum power that is necessary for communications when operating the antenna indoors.]*

When considering possible outdoor locations, never place the antenna where it could possibly fall on someone. Since it is likely that you will eventually drop part of the antenna, attach a safety cord to each element before putting it out the window to mount it, and tie the other end to a heavy piece of furniture.

A patent application is pending on these coils, but amateurs are welcome to build this antenna for their own use. Coil ribs and antennas are available from Urban Antennas, Inc., P.O. Box 662, Bryn Athyn PA 19009; (215) 947-0235. ■

Table I

Loading Coil Dimensions

Band	Turns for 8' antenna length
12m	1.0
15m	2.0
17m	2.3
20m	4.0

Number 19 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /The Special Events Message Area #4 on our BBS, (603) 924-9343, for listings that were too late to get into publication.

JUL 10-11

MAPLEWOOD, MN *Amateur Fair '92* will be held at the Aldrich Arena, 1850 White Bear Ave. Fri. schedule: Outside Flea Market from 6PM-9:30 PM; Commercial Exhibits from 6 PM-10 PM. Sat. schedule: Outside Flea Market 6 AM-3 PM; Commercial Exhibits 8 AM-3 PM; Grand Prize drawing 2:30 PM. The event is hobby oriented, catering to amateur radio operators, electronics hobbyists, and PC users. Admission is $6. Children under 6 free when accompanied by an adult. Free parking. Ticket holders may sell from the Giant Outdoor Flea Market at no additional cost (no electricity). For info contact ***Amateur Fair, PO Box 26331, St. Paul MN 55126; (612) 653-9999.*** Computer users can call ***HAM-LINK*** at ***(612) 426-0000 (300-9600 baud).***

JUL 10-12

U.S.A./CANADIAN BORDER North Dakota and Manitoba's International Ham Fest will be held at the Peace Garden. Registration will begin on the afternoon of the 10th. The Fest will end at noon on the 12th. Flea Market. Transmitter Hunts. Sunday morning Breakfast for all. The Peace Garden is located just a few miles north of Dunseth ND, or a few miles south of Boissevain, Manitoba. Contact ***Dave Snydal, 25 Queens Crescent, Brandon, Manitoba, Canada R7B-1G1.***

JUL 11

NORTH CHARLESTON, SC The Charleston II Summer Hamfest/Computer Expo will be held from 8 AM-3 PM at the Chas. Southern Univ. Field House, North Charleston SC. Exit-205 I-26, US-78 East. Free parking. Advance tickets: $6 family admission (2+), plus 5 prize tickets. At-the-gate tickets: $5 single admission plus 1 prize ticket. Additional prize tickets: $1/ea.; 6/$5. Auction after 2 PM. Inside Flea Market Tables 1/$10, Addt'l/$7.50 ea.; Dealer Tables (wall space and elec.) 3/$39, 5/$55, addit'l tables $8/ea. Outside vender space and tailgaters: 1st 8' space $3; $8 each addt'l space. Dealer and Flea Market contact: ***Roy Morrow N4ARA, (803) 871-5914 (H); (803) 851-0600 (W).*** Tailgate/Outside Vendor, tour and reservation help, contact: ***John Simons KC4UCP, (803) 875-3135(H).*** Talk-in on 147.27+/224.64-/443.80+.

PETOSKEY, MI The Straits Area ARC will sponsor a hamfest from 8 AM-1 PM at the 4-H Bldg., Emmet County Fairgrounds, 2 blocks W of US 31/131 intersection. VE Exams, Flea Market. Admission $3. 8' tables $3. Talk-in on 146.08/.68 and 146.52. Contact ***Tom Romanauski N8KHE, (616) 436-5033.***

SUMMERVILLE (CHARLESTON), SC The Trident ARC will sponsor *Charleston II—Summer Hamfest & Computer Expo* at the Charleston Southern U. Fieldhouse, I-26 (Exit 205) and US-78 East, from 0800Z-1500Z. Radio, Computer and Software dealers. Set-up at 0600. Wheelchair access. Free parking. Campground and motels nearby. Advance tickets $6 per family; $5 each at the gate. Tailgate $3. Tables $10. Dealers (call). True-Auction at 1400 hrs. Talk-in on 147.27+, 224.64-, 443.80+. Mini-vacation planning assistance. Atlantic Ocean beaches 25 miles. Contact ***Chairman: Bubba Johnson N4CII, 5 Shoo Fly Cir., Givhans SC 29472; (803) 821-8100 (recorder),*** or ***(803) 871-7741.***

JUL 11-12

BILLINGS, MT The Yellowstone RC, Inc., will hold a Hamfair at the Yellowstone County Fair Grounds, Metra Park Turf Club. Shuttle service from Billings Logan Internat'l Airport. Set-up will be all day Fri., Jul 10th. RV parking $9.50 per day, or $22.50 for 3 days, w/electrical hookups. Hotel room discounts are available at the Airport Metra Inn (only $28 per night). Registration fee is $35. Advance tickets $5, $6 at the door (deadline June 30th). Swap Tables: Admission plus $10 each; $5 for half table. Talk-in on 147.200+ MHz, 147.360+ MHz, 3900 kHz. Send check or money order for advance package to ***Yellowstone Radio Club K7EFA, Eileen C. Jones K7BFJ, Club Sec., 1544 Foothill Dr., Billings MT. 59105.*** Please SASE. Get more info from ***Vince KB7ADL, (406) 252-8029, eves.; Eileen K7BFJ, (406) 252-2045, eves.;*** or ***Verlon K7AEZ, (406) 245-3930, days.***

JUL 12

OLD WESTBURY, NY The Long Island Mobile ARC will sponsor a Hamfest at the New York Institute of Technology, Route 25A, Old Westbury NY, from 9 AM-4 PM. VHF tune-up clinic. No advance, $5 at the gate. Exhibitors $10. Talk-in on 146.25/.85. Contact ***Neil Hartman WE2V, (516) 462-5549,*** or ***Mark Nadel NK2T, (516) 796-2366.***

AUGUSTA, NJ The Sussex County ARC will hold a Hamfest at the Sussex County Fairgrounds, Plains Rd., off Route 206, starting at 8 AM. Free parking. Admission $4 (XYLs and harmonics free). Tailgate $6. Indoor Flea Market $8 per space (limited supply of tables). Talk-in on 147.90/.30, 222.90/224.50, 146.52. Contact ***Don Stickle K2OX, 185 Weldon Rd., Lake Hopatcong NJ 07849; (201) 663-0677.***

BOWLING GREEN, OH The Wood County ARC will sponsor its 1992 Ham A-Rama at the Wood County Fairgrounds on Poe Rd., in northwest Bowling Green,

starting at 8 AM. Free admission and parking. VE Exams. Trunk sales $5. Inside tables $10. Talk-in on 147.78/.18. Contact ***Wood County ARC, PO Box 534, Bowling Green OH 43402; (419) 352-3260.***

PITTSBURGH, PA The North Hills ARC will hold its 7th annual Hamfest from 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd. (10 miles north ol Pittsburgh on Rt. 19N or McKnight Rd. From I-79 or the Pennsylvania Turnpike, take Rt. 19S through Wexford, turn left onto Cumberland Rd. at the second traffic light after Chunky Cheese. Talk-in will be on 147.09 (the W3BIS Allegheny County Public Service rplr). Limited indoor tables $10 each. Free admission and parking. One free automobile-sized space per tailgater; each additional space $5. Wheelchair accessible. Contact ***Don Jackson N3LAZ, 8 Dale Ave., Bradford Woods PA 15015; (412) 935-3343.***

DOWNERS GROVE, IL The DuPage ARC will sponsor their 10th annual Hamfest/Computer Mart, beginning at 8 AM at the American Legion Post 80, 4000 Saratoga Ave., Downers Grove IL. Post 80 is located about 20 miles west of Chicago, one block north of Ogden Ave. (Rte 34), and one block west of Main St. From I-88 exit at Highland Ave. south to Ogden, west on Ogden one block to Saratoga, one block north on Saratoga to the American Legion Post 80. Flea Market. Tailgating. Free Parking. VE Exams for all classes; please bring your license, copy of license, photo ID and certificate of successful completion, if appropriate. Tickets $3 in advance, $4 at the gate. Talk-in on 146.52 MHz simplex and 145.25 MHz -600, (CTCSS 107.2 Hz). For tickets, tables or info, SASE, or call ***Edwin Weinstein WD9AYR, DARC Hamfest Chairman, 7511 Walnut Ave., Woodridge IL 60517. Ham line (708) 985-9256.***

JUL 17-19

ESSEX, MT The 58th Annual Glacier-Waterton Internal'l Peacepark Hamfest will be held at the Three Forks Campground, Essex MT. Advance tickets (before July 3) are $8.50; $20.50 after July 3. VE Exams. For registration write to ***Ethel Ferree KA7HEX, Box 75, Wolf Creek MT 59648,*** or call ***Pete KF7R, (406) 222-2601.*** All are welcome. Talk-in on 146.52. For info contact ***Sheila Devitte VE6NOW, (403) 282-2171.***

JUL 18

SALISBURY, NC The North Carolina Chapter of the Triple States RAC, will sponsor a "Firecracker Hamfest" at the Salisbury Civic Center from 9 AM-5 PM. Admission, $3 in advance (with SASE), $4 at the door. No additional charge for Flea Market. Tables in air conditioned area, $5. Set-up at 3 PM-9 PM Fri., 7 AM Sat. FCC Exams by W5YI. ARRL Forum at 10 AM. VEC Exams at 1:30 PM. Pre-registration required with form 610, copy of license, and $5.25 fee. Send to ***Isabell Ledford, PO Box 826, Cooleemee NC 27014.*** Talk-in on 146.73 or 146.655. Directions: From Interstate #85, take Hwy. #52 west/East Innes St. Turn left on South Boundary St., the Fest is on the left. For info and pre-registration contact ***Walter Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071.***

ABILENE, KS The Smoky Valley RC will sponsor a Hamfest from 9 AM-4 PM at Eisenhower Park. VE Exams. Talk-In on 146.88 or 145.33. Contact ***Bill Fenton WØOIN, 315 S. Washington, Junction City KS 66441; (913) 238-7817.***

JUL 19

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, will co-sponsor a TAILGATE Electronics/Computer/Amateur Radio Flea Market from 9 AM-2 PM at Albany and Main Streets. Admission $2. Free off-street parking. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Sel-up at 7 AM. Call ***(617) 253-3776*** for reservalions and info. Mail checks before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/444.725 - pl 2A - W1XM/rptr.

WASHINGTON, MO The Zero Beaters ARC will hold its 30th annual Hamfest at the Bemie H. Hilleman Park (Washington Fairgrounds), from 6 AM-3 PM. Flea Market parking $4 a space. VE Exams (walk-ins, starting at 10 AM—bring original license and a photocopy). Free parking. Free admission. Talk-in on 147.24 and 444.90 rptrs. Contact ***Craig Brune NØMFD, PO Box 24, Dutzow MO 63342; (314) 239-0060 days; (314) 281-2784 eve. and weekends.***

FLINT, MI The 4th annual Swap and Shop, sponsored by the Genesee County RC, will be held at Dom Polski Hall on North Linden Rd., 1 mile west of I-75 and 1/4 mile south of Pierson Rd., 8 AM-1:30 PM. Advance tickets $3, $4 at the door. Talk-in on 147.340/.940, 146.52 simplex or 444.200. Send checks or inquiries along with an SASE to ***Swap Committee, GCRC, PO Box 485, Flint MI 48501,*** or call ***Tom N8DYN, (313) 743-3980*** for more info.

JUL 25

NORTH BEND, OR The Coos County RC will host the 2nd annual Southern Oregon Coast Hamfest at the North Bend Jr. High School from 9 AM-5 PM. Free parking. Free RV parking all weekend. VE Exams. Advance tickets $4, $5 at the door. Tables $15. Large shopping mall within walking distance. Contact ***R. Lyon N7SBF, Coos County Radio Club, PO Box 3494, Coos Bay OR 97420. Tel. (503) 888-2317.*** Talk-in on 146.01/.61 K7CCH rptr.

LANCASTER, PA The Red Rose Repeater Assn. will sponsor a Computer Fest at the McCaskey High School from 9 AM-3 PM. Set-up at 7 AM. Admission $4; children under 14 free with paying adult. Vendor contact: ***Wade Mackey, 5 Sunrise Terr., Millersville PA 17551; (717) 872-5328.***

JUL 25-26

OKLAHOMA CITY, OK The 19th annual Ham Holiday and State ARRL Convention, sponsored by Central Oklahoma Radio Amateurs, Inc., will be held at the Made in Oklahoma Bldg., Oklahoma State Fair Park. Doors open at 8 AM both days. Giant Flea Market, new and used equipment, VE Exams on Sat., RF Foxhunt, packet, computer, AMSAT, etc. Dinner Sat. eve.; QCWA Breakfast Sun. morning. Advance tickets $6, $8 at the door. Tables $5 in advance, $7 at the door. Talk-in on 147.03/.63. Contact ***Ham Holiday 1992, PO Box 95942, Oklahoma City OK 73143-5942.***

JUL 26

MILFORD, CT The Coastline Amateur ARA will hold VE Exams for all classes at the Fowler Bldg., 145 Bridgport Ave., at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125,*** or ***Dick WA1YQE, (203) 874-1014.***

TIMONIUM, MD The BRATS Maryland Hamfest/Computer Fest will be held at the Maryland State (Timonium) Fairgrounds on York Rd., off I-83 and I-695, from 6 AM-3 PM. Admission $5 per adult; children under 12 free. 8' tables in the Main Exhibit Hall are $50 each (includes AC power and one admission ticket). 8' tables in the Home Arts Bldg. are $25 each, no AC power; admission is additional. Set-up at 2 PM Sat. Tailgate area set-up 2 PM Sat., $5 per vehicle space. Buyers, please note: This is *not* a 2-day hamfest. Sat. PM access is for dealer and tailgating set-up *only*. VE Exams Sun. at 10 AM in Administration Bldg.; mail your completed Form 610 to ***John Creel WB3GXW, 3208 Kilkenny St., Silver Spring MD 20904.*** For tables, info, write to ***BRATS Hamfest, PO Box 5915, Baltimore MD 21208*** or call Table Chairman ***Franz Niedermeyer N3HFS, (410) 583-9147*** anytime.

AUG 1

COLUMBUS, OH The Voice of Aladdin ARC will host a Hamfest from 8 AM-5 PM at Aladdin Shrine Temple, Morse Rd. and I-270 Juction on the east side of Columbus. Advance tickets $3, $4 at the door. Flea Market/Trunk sales $2 per vehicle. Tables $5 in advance, $6 at the door. Advance registration preferred. Make checks payable to ***Voice of Aladdin ARC*** and mail with requests and SASE to ***James C. Caines KB8KME, 1056 Erickson Ave., Columbus OH 43227-1241.*** Walk-in VE Exams.

AUG 8

HUNTINGTON, WV The Tri-State ARA will sponsor Hamfest '92 & Computer Show starting at 8 AM at the Huntington Civic Center. Set-up at 6 AM. Walk-in W5YI testing for all license classes. Wheelchair accessible. YL and XYL activities. Close to all accommodations and restaurants. Donation, adults $5, children 12 and under, free. For more info, call ***Bill KF8QK, (304) 522-1933,*** or ***Alan N8LNS, (304) 736-9303,*** anytime.

AUG 14-16

PARK CITY, UT WIMU '92 and the ARRL Rocky Mountain Div. Convention will be at the Olympia Hotel. Phone ***1-800-234-9003*** for reservations; mention WIMU '92 for special rates. VE Exams Fri. at 6 PM; call ***NV7V, (801) 465-3983*** to register. UARC is sponsoring a Steak Fry Sat. at 6 PM; $12 per person. Swap meet starts Sat. at 8 AM, no charge for tables. Sun. at 8 AM, an All-You-Can-Eat Buffet, $6.95 per person. Preregister before Aug. 1, $10; after Aug 1 and at the door, $15. Children under 12 may register at any time for $4. Send registration requests and checks to ***WIMU '92, PO Box 67, Bountiful UT 84011-0067.*** You *must* be registered to attend these events.

SPECIAL EVENT STATIONS

JUN 28-AUG 13

SEQUOIA NATIONAL FOREST, CA Radio Station N6PZA will be operating portable from Boy Scout Camp Whitsett, on a when-time-permits basis. Camp Whitsett is located in the southern portion of the Sierra-Nevada Mountain Range, 32 mi. north of Kernville CA. Operation will be in the 40 and 17M bands Mon.-Fri. during 2100-2400 UTC; and 17 and 20m Mon.-Thurs., 0100-0400 UTC, with occasional operation on 10m. Send inquires to ***Chuck Smith N6PZA, PO Box 1867, Lake Isabella CA 93240-1867.*** We would like to establish a possible Scout/Summer Camp Net with all Boy or Girl Scouts, Scout leaders, or Ham Radio licensed Camp Staff members who work at Boy or Girl Scout or other Youth Camps during the summer. Listen for Camp Whitsett on the General portions of the Ham Bands (especially 17, 20 and 40m) during the day.

JUL 2-12

CALGARY, ALTA. CANADA Station CJ6CEXS will operate from the Calgary Stampede, to celebrate the 125th anniversary of Canada. There will be a 8 x 10 full color poster award for $5 U.S. funds. Any contact on any mode/band qualifies. Special QSL cards will be sent out. Talk-in on 146.850 -600 VE6RYC rptr. On the grounds, use 146.520 simplex. ***QSL via VE6NAO.***

JUL 4

DELTAVILLE, VA The Middlesex AR Group will operate AC4OG, 1230-2030 UTC to commemorate Deltaville's 4th of July Celebration. Operation will be in the General portion of the 80, 40 and 20m bands. For certificate, send QSL and SASE to ***Pat Muller AC4OG, M.A.R.G., PO Box 148, Locust Hill VA 23092.***

NEILLSVILLE, WI Station N9MCH will be operated by the Clark County ARES, from the Highground Veterans Memorial Park located 2 1/2 miles west of Neillsville, in southern Clark County, just off US Hwy. 10. The station will operate from 1700Z-0500Z (12 PM noon CDST to 12 AM midnight CDST). Frequencies: The bottom portion of the General 80m, 40m, 15m, and 10m phone subbands. For a Certificate, send your QSL and a 9 x 12 SASE to ***The Highground, PO Box 457, Neillsville WI 54456.***

PISCATAWAY, NJ N2HOQ will operate the first 326 minutes (0000-0526Z) to celebrate the 326th Anniversary of the town. RTTY only on various HF bands. For certificate, send QSL and 9 x 12 SASE to ***Geoff Malta, PO Box 312, Piscataway NJ 08855.***

STAUNTON, VA The Valley ARA will operate Station WB8GIF in conjunction with the Statler Bros. Happy Birthday USA. Operations will take place in the General portion of 80, 40, 20 and 15m CW and phone bands, and the Novice 10m band. For special glossy Certificate, send 9 x 12 SASE to ***VARA, PO Box 666, Staunton VA 24401.***

JUL 4-5

BUFFALO, NY/FT. ERIE, ONT. CANADA The South Towns ARC will operate Station WB2ELW and Niagara South ARC will operate Station VE3NKH, to commemorate the 65th Anniversary of the opening of the Peace Bridge over the Niagara River (connecting Buffalo NY and Ft. Erie Ont.). They are also celebrating the annual Friendship Festival commemorating 180 years of friendship between the U.S. and Canada. Operation will be in the lower 25 kHz of the General phone subbands, the Novice 10m phone subband, the CW General subbands, 10m Novice CW subband, the WB2ELW rptr., 147.09 MHz (+600 kHz transmitt) and the VE3NKH rptr., 147.165 (+600 kHz transmitt). For certificate: US amateurs send QSL and SASE to ***John Leiten WB2ELW, 6120 McKinley Pkwy., Hamburg NY 14075.*** Canadian amateurs, send QSL and SASE to ***John Gilmour VE3NKH, 158 High St., Fort Erie, Ont. Canada L2A 3R1.***

JUL 10-11

PEACE GARDEN, NORTH DAKOTA/ MANITOBA BORDER In conjunction with their 29th North Dakota/Manitoba International Hamfest, VE4IHF/Ø will be in operation as a Special Event Station. Operation will be from 9 AM-5 PM. Frequencies: 3.937, 7.255, 14.255, 21.355 and 28.355, plus or minus.

JUL 11-12

U.S./CANADA Amateurs affiliated with the American Sunbathing Assn., The Naturist Society, and Federation of Canadian Naturists will sponsor operation of as many as 12 SE stations (40-2 meters; 10 AM-3 PM local time) to celebrate National Nude Weekend. For certificate, indicating all sites worked, send QSL(s) and 9 x 12 SASE to ***AE3D, PO Box 5407, Laurel MD 20707-5407.***

NORWOOD, NY The St. Lawrence County 10m Assn. will operate WN2R to celebrate the annual "Norwood Regatta" at Norwood NY. Operation will be on the General portion of 40m and 20m and the Novice portion of 10m from 12 noon-7 PM, EDT. For a special QSL, send QSL and SASE to ***Regatta, General Delivery, Norwood NY 13668.***

JUL 15

ATKIN, MN The Barton Amateur Radio Family will operate KØPVB from 1800Z-2400Z to commemorate their 40th annual visit to Sunset Bay on Cedar Lake. Operation will be in the 40, 20, 15 and 10m bands. For a certificate and honorary membership in B.A.R.F., send QSL and SASE to ***B.A.R.F., c/o KAØWOW, 1441 West 41st St., Davenport IA 52806.*** SWLers encouraged to respond.

JUL 11-12

FULTON, NY The Oswego County Amateur Radio Emergency Service will operate KY2F from 1200Z-2100Z each day, from the Central New York Internat'l Air Show at the Oswego County Airport. Frequencies: The middle of the General 80, 40, 20, 15, and 10m phone bands; Novice portion of 10m, 147.75/.15 MHz., and packet on 145.05 MHz. For certificate, send your QSL card and a large SASE to ***Fred Swiatlowski KY2F, PO Box 5227, Oswego NY 13126.***

JUL 11-19

WOOSTER, OH The Wayne AR Technical Soc. will operate N8CEY 1200Z for 15 hours Jul. 11-19 to celebrate the Ohio Agricultural Research and Development Center, "A Century of Science" at Wooster. CW: 3.550, 7.050, 10.125, 14.050, 21.050, 24.920, 28.150; Phone: 3.900, 7.275, 14.275, 21.350, 24.960, 28.350. For certificate, send QSL and a SASE to ***OARDC, Mike Brugger N8CEY, 1680 Madison Ave., Wooster OH 44691.***

JUL 12

LA GRANGE PARK, IL The Six Meter Club of Chicago will operate K9ONA 1400Z-2359Z to commemorate the centennial of La Grange Park. Frequencies: Novice portion of 10m, and 146.37/.97 K9ONA rptr. For QSL, send SASE; for certificate, send 9 x 12 SASE to ***K9ONA, Karl Weisshappel, 802 Barnsdale Rd, La Grange Park IL 60525.***

JUL 18

DENVER, CO The Rocky Mountain Radio League will launch a high altitude balloon carrying a cross-band rptr. with the ID of NØFVG BALLOON REPEATER, at 1400Z. The input frequency will be 446.000, with the output of 147.555. The expected max. altitude will be close to 100,000 feet. Stations 500 miles from Denver should be able to check in. Flight duration will be about 4 hours. There will be a conducted net on this rptr. All stations that check in will be sent a commemorative QSL card. Send your QSL card with an SASE to ***Warren Gretz NØFVG, 3664 E. Lake Dr., Littleton CO 80121.***

JUL 18-19

STATEN ISLAND, NY The Staten Island ARA will operate W2CWW from Sat. at 1200Z-1500Z Sun., to celebrate their 70th Anniversary with the ARRL. Operation will be in the lower 25 kHz of the General 80, 40, 20 and 15m phone subbands, and the Novice portion of the 10m phone subband. Also 445.325 -5 156.7pl club rptr. For a Certificate suitable for framing, send your QSL with a 9 x 12 SASE to ***Staten Island ARA, PO Box 140495, Staten Island NY 10314-0018.***

TALLADEGA, AL The Talladega RAC will operate Station AA4UF from the Third Annual Induction of the International Motor Sports Hall of Fame, Jul. 18 from 1300Z-0500Z, and Jul. 19 from 1300Z-2300Z on 14.270 MHz (+/- QRM), in the 20m phone band and the middle of the 10m Novice phone band. For a Certificate, send QSL and two units of postage to ***TRAC, PO Box 626, Talladega AL 35160.***

JUL 24-AUG 8

MONTREAL, QUEBEC, CANADA Station CI2M will operate daily, Jul. 24-Aug. 8, from 1300-0100 UTC, to commemorate the 350th Anniversary of Montreal. Frequencies: SSB: 3.875, 7.250, 14.250, 21.350, 28.350 +/- QRM. SSTV: 14.230; Packet: 145.03; ATV: 439.25; VHF: 50.135, 147.045. A special QSL card will be available. Please QSL with SASE, or via VE2 bureau to ***CI2M via VE2CUA, Concordia University ARC, c/o CUSA H-637, 1455 DeMaisonneuve West, Montreal, Quebec, Canada H3G 1M8.***

JUL 27-AUG 2

CANTON, OH The Canton ARC will operate Station W8AL from 2200-0200 UTC Jul. 27-Jul. 31; and from 1700-2300 UTC Aug. 1-2, to celebrate the Pro Football Hall of Fame Greatest Weekend. Frequencies: SSB: 28.350, 21.350, 14.270, and 7.270; CW: 28.150, 21.060, 14.060, and 7.060. There will also be RTTY, Packet, Amtor, and 2m FM operation. SWLs welcome. For an unfolded Certificate, send your QSL and a 9 x 12 SASE, with two units of first class postage. For a QSL or a folded certificate, send your QSL and a #10 (business size) SASE to ***Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306.***

JUL 31-AUG 2

DARMSTADT, GERMANY The Wiesbaden ARC will operate DA1WA/P from Frankenstein Castle, on all bands 80-10m, CW, SSB, Packet, and digital modes. A special QSL card has been printed especially for this event. QSL to ***DJØPU***, SAE with 2 or 3 IRCs or "greensamps." For more info, contact ***Rob Kipp DJØPU, Huegelstr. 25, D-W-6070 Langen, Germany.***

AUG 1-16

LEWISTOWN, PA The Juniata Valley ARC will operate Station K3DNA in celebration of the 25th Anniversary of the US Canoe Assn. Nat'l Championships. Frequencies: The General portion of the SSB band as well as on CW. Most operation will be during the week of Aug 1-8. For a special Certificate, send an SASE to ***K3DNA, PO Box 73, Yeagertown PA 17099.***

Number 20 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202-N
Peterborough NH 03458

More Digits

Last month, we were discussing digital technology. Let's continue.

Abracadabra

There are various ways to convert an analog signal to digital form and back again. The analog-to-digital converter, or ADC, has evolved over the years, with various types suited to differing tasks. One common type of ADC, the successive approximation register (SAR), works in an iterative fashion. It makes a rough guess of the correct digital value of the sample and then reconverts its guess to analog form. Then, it subtracts the reconverted voltage from the original signal in a differencing amplifier. What's left is the difference between them, which corresponds to the error in the ADC's guess. It then makes another approximation in an attempt to accurately digitize the error. With each guess, the digital representation of the signal gets closer and closer to being correct. Finally, all the error is cancelled out and the conversion is complete. This technique works remarkably well, but it takes time, due to the repetitive nature of the process. SAR converters are fine for low-frequency measurements and some audio work, but they just aren't fast enough for video or other high-frequency applications.

There's a much faster type of converter, called a flash converter, which is especially useful for video, because of its speed. This converter takes only one "pass" to completely convert its input sample. It uses a large array of voltage comparators to detect the sample's voltage. The outputs of the comparators are converted into a digital word with some logic gates. It doesn't get much simpler than that! So why not do all A/D conversion this way? Well, when you get up to more than a few bits of resolution, the number of comparators and logic gates gets to be unwieldy. Putting 65,000 comparators and thousands of gates on one chip ain't easy, especially since each comparator requires a precision, laser-trimmed resistor to provide its voltage reference. As you might imagine, flash converters are expensive.

There are other kinds of ADCs, but the objective is always the same: to sample the input waveform at discrete intervals and convert each sample into a digital number, with as little error as possible.

Hold It Right There

No matter what digitizing technique is used, the conversion process takes time. Unfortunately, the incoming signal may change during the conversion period, introducing serious errors in the measurement. For that reason, a sample and hold circuit, which does exactly what the name implies, is used to freeze the voltage being measured until the measurement is complete. In older systems, the sample and hold circuitry was separate from the ADC, but most modern ADCs include it right on the chip, making circuit design simpler.

Give It Back!

The process of reconverting a digital signal into its original analog form is easier than the reverse. A set of gates whose outputs are summed by a network of precision resistors makes a perfectly decent digital-to-analog converter, or DAC. Thanks to CDs, though, various new techniques for ultra-clean D/A conversion have evolved. In pursuit of ever more perfect sound, designers have developed such things as oversampling and bit interpolation, which actually synthesize data values in between the existing ones in order to make the resultant waveform smoother and easier to filter. Such things, however, are overkill for voice-grade networks; a simple resistive DAC will do fine.

We've seen how we can digitize an audio signal and the benefits and costs of doing so. Is it practical to send digitized information over the air and recover it at the receiving end? Well, maybe. The broadcast industry is experimenting right now with sending it over UHF, with the intent of providing compact-disc-quality audio directly to your home. Eventually, they plan to do away with traditional AM and FM altogether, though I expect it will be phased out over many years. So, don't go hauling your stereo gear to the hamfest just yet! Initial tests indicate that it takes far less power, compared to FM, to get the digital data across, despite the required higher bandwidth. I, for one, look forward to the time when we all aren't drenched with megawatts of RF, 24 hours a day. Of course, TV broadcasting, especially on the UHF channels, contributes most to the RF soup in which we all live. But who knows, maybe that too will be digital one day.

What About Us?

Could we hams use digital voice links? Sure, why not? For local work, digital would be excellent, perhaps providing far greater coverage from our walkies and repeaters, and perhaps making multiple-user single-channel repeaters a reality. For HF, though, it's another story. The fading, static and QRM, at least as they exist today, would likely make data recovery very difficult. Also, high-speed, noise-tolerant modems would have to be developed at prices we could afford. If it could be done, though, we might fit far more QSOs on each band, with no audible interference from adjacent stations. It may happen, but I doubt it will be soon.

Psst . . . DSP

More likely, digital techniques will be showing up more and more in applications which help conventional analog systems work better than they ever have before. Already, we're seeing signal processors employing the powerful new technology of digital signal processing. Based on a high-speed, dedicated microprocessor system, DSP devices can filter audio in ways undreamed of before. For instance, you can buy a DSP notch filter which not only removes heterodynes in the conventional manner, it also finds them automatically. Even more amazing, the filter can remove several tuner-uppers at the same time! And the notch is far deeper and narrower than you can get with any analog filter; the whistles really disappear, and the desired speech signal is essentially undamaged.

Also currently available is an audio filter which can remove much of the interference caused by adjacent voice stations, along with static. This DSP filter actually analyzes the incoming waveform, looking for patterns related to normal speech. When it detects elements which don't belong there, it removes them, leaving the speech untouched. I haven't actually used such a filter, but a friend of mine has, and he says that the result is truly spectacular. Even 20m SSB can be pleasant to listen to! As the chips become more affordable, we may begin to see such filters incorporated into new radios. Even today's best rigs will sound very unsatisfying next to the DSP-equipped ones. There's a big future in DSP audio filtering technology.

Made to Order

Another area in which DSP shines is the modeling of hardware in software. In other words, a piece of hardware, such as a modem, can be emulated in the DSP chip's software. Why do it? Because you can get the same or better result with far fewer parts. Perhaps as important, you can change the circuit's characteristics simply by changing the software, with no other modifications necessary. So, as modem speeds increase through the use of more sophisticated modulation techniques, the new designs can be implemented merely by swapping a chip! Already, some multimode data controllers are using this technique, making the products nearly obsolescence-proof.

The Ultimate

If you can model an audio channel in software, thus doing away with most of the hardware, why not do the same thing for an entire receiver or transmitter? Well, in theory, there's no reason why not! Imagine it: The antenna leads to a front end amplifier which feeds an ADC. The digital data goes into a DSP chip and out comes audio. AM, FM, SSB, you name it, the DSP can demodulate it. Tuning, of course, is handled by changing some numbers in the DSP routines. Filtering is accomplished the same way, and it can be tremendously sharper than anything we can make out of crystals or ceramics now. A rig small enough to fit into a pocket, or even be worn on your wrist, might have all the features and quality of a full-sized HF rig, and there'd be absolutely no variation from unit to unit within a given model—they'd all perform exactly the same. Wow, that's some nifty radio. No IF coils, no mixers, nothing. So why aren't we doing it?

The answer is simple: speed. It takes a DSP running at 20 MHz or more just to do audio. Imagine what it would take to process signals which are themselves in the megahertz range. Today's DSPs aren't even in the ballpark of being fast enough. But make no mistake about it, as integrated circuit manufacturing techniques advance, it will be done. To our grandchildren, and perhaps even to our children, IF coils, ceramic filters and analog receiver circuitry will seem as silly as spark transmitters do to us today. Heck, even you and I may QSO on DSP sets before our silent key notices grace the pages of history. Hey, by then we may even have settled the no-code debate! Of course, that may be asking a bit much.

Well, that about covers it in the digital domain. Now, let's look at a letter:

Dear Kaboom,

I am in need of an amplifier that will put out a couple of watts in the VHF range. Will your "Cassette Box Special" (73 Amateur Radio, *April 1990) amp do it at those frequencies? What's the difference between HF and VHF amps anyway?*

Signed,
Watt Pusher

Dear Pusher,

I seriously doubt the Cassette Box amp will do it for you! In basic concept, an amp is an amp, and they should all work at any frequency. But it just doesn't work out that way. RF amplifiers must deal with circuit reactance, especially component capacitances. If you try the Cassette Box amp at VHF, it probably will show *loss*, not gain, as it was designed to work at about 1/40 the frequency you have in mind. To get gain at VHF, you need to use the right transistor and certain low-reactance construction techniques. In particular, it is easiest to use a tuned amplifier, which permits component reactances to be used to advantage, in contrast to the wideband designs commonly used at HF.

73 and see you all next month.

Number 21 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

EEB

Lowe receivers are now available in the U.S. and Canada. The new compact, go-anywhere HF150 is rugged, portable and performs like a giant. It covers 30 kHz to 30 MHz, AM, AMN, USB and LSB, plus four AM synchro detection modes. It also includes 60 memories, a large LCD readout, 10-15 VDC, 150 mA operations. Available options: keypad, NiCds (8-AA), whip antenna, 120 VAC adapter. This unit is a great companion for a QRP field operation. It's just 7.3" x 3.2" x 6.3", weighs 2.9 pounds, and comes in a rugged metal alloy case.

For the price and more information on the Lowe HF150, contact *EEB, 323 Mill Street N.E., Vienna VA 22180; (703) 938-3350, (800) 368-3270, Fax: (703) 938-6911.* Or circle Reader Service No. 201.

PERIPHEX

Periphex has announced longer operating time, higher capacity, lower cost batteries for popular ICOM, Kenwood and Yaesu handhelds. For ICOM models, the BP-112S (7.2 volts, 800 mAh) offers a 15% increase in operating time at low power; the BP-114S (7.2 volts, 1700 mAh) offers a 45% increase at low power; and the BP-115S (12 volts, 800 mAh) offers a 100% increase at 5 watts output. The BP-112S is $45; the BP-114S and the BP-115S are $79 each. For Kenwood models, the PB-13S (7.2 volts, 1200 mAh) offers a 60% increase in operating time at low power, while the PB-14S (12 volts, 400 mAh) offers a 33% increase at 5 watts output. The PB-13S is priced at $49.75 and the PB-14S is $60. For Yaesu models, the FNB-26S (7.2 volts, 1400 mAh) offers a 40% increase in operating time at low power, while the FNB-27S (12 volts, 800 mAh) offers a 33% increase at 5 watts output. Both Yaesu batteries are priced at $65 and are 3.75 Inches tall.

All battery packs include overcharge over-temperature and short circuit protection, and a one-year warranty. They are completely compatible with appropriate chargers. For more information, contact *Periphex, Inc., 115-1B Hurley Road, Oxford CT 06478; (203) 264-3985, (800) 634-8132, Fax: (203) 262-6943.* Or circle Reader Service No. 202.

SGC

The SG-2000 HF SSB from SGC is an American-made, remote-control head, full-coverage transceiver providing global HF communications on voice and data. The SG-2000 features scanning capability, a large LCD frequency display and ARQ/FEC capabilities. The Model SG-2000 is a solid commercial HF SSB transceiver which incorporates unique features appealing to the commercial, military, marine and amateur markets. It produces 150 watts and operates on the 1.8 to 30 MHz frequency bands. It is operational in voice and data transmission, has CW with sidetone, and is remote ready. The unit has all functions built in for HF SSB operation, including remote capability (up to 8 remote stations) through telephone lines. It can be controlled by an IBM or compatible computer without its removable front panel. Designed with a direct entry VFO and 644 ITU channels, plus 100 user-defined memories, the SG-2000 will operate on all marine, commercial and ham frequencies and includes receive capabilities for broadcast, shortwave broadcast and weatherfax frequencies. A unique suction cup mount system allows the SG-2000 control head to be installed on a vehicle dashboard without drilling holes.

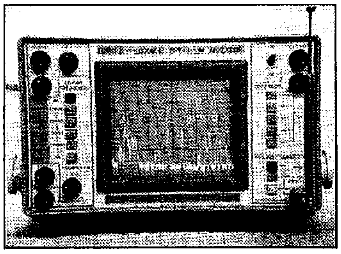
The retail price for the SG-2000 HF SSB radiotelephone is $1995. For more information, contact *SGC Inc., SGC Building, 13737 S.E. 26th St., Bellevue WA 98005; (206) 746-6310, Fax: (206) 746-6384.* Or circle Reader Service No. 203.

LINK PLUS

Link Plus Corporation has announced that, for the first time, its unique and powerful Link-Plus® signal processing technology will be made available to amateur radio operators in a new product called the MULE™. The MULE, or Multi-Use-Link-Enhancer, is a rugged, stand-alone unit that can be connected quickly and easily to any amateur radio with external cables. It is designed to allow amateur radio operators to quickly upgrade the voice quality of their radio systems without changing existing radio equipment, and without having to upgrade power and antenna systems.

The Link-Plus technology that is the heart of the MULE is an advanced, compact and cost-effective version of the linked compressor and expander technology originally developed by the telephone industry to improve the quality of high frequency radiotelephone communications. The MULE greatly improves the "quality" of voice communications in the 2-30 MHz frequency range by eliminating all interference, channel noise and signal fade from the radio link and by significantly boosting the effective strength of the radio signal. The MULE's technology has been extensively tested and has been incorporated into both international and U.S. government HF radio performance standards.

For the price and more information, contact *Link Plus Corporation, 9052 Old Annapolis Road, Columbia MD 21045; (301) 982-1585, Fax: (410) 997-3485.* Or circle Reader Service No. 204.



ITC INSTRUMENTS

The SA1000 1000 MHz analyzer from Instruments Technology Corp. is a stand-alone, full-function 1 GHz spectrum analyzer with a dynamic input range greater than 115 dB. The SA1000 has a three-step 40 dB attenuator, a baseline clipper, and a push-button frequency selector for excellent center frequency accuracy. A DC to 50 MHz per division push-button dispersion control gives you a full 80 dB on-screen dynamic range from DC to 50 MHz dispersion settings with no degradation in the on-screen dynamic range.

The suggested retail price is $1695. For more information, contact *ITC Instruments, 3678 Mt. Ariane Dr., San Diego CA 92111; (619) 277-4619, (800) 232-3501.* Or circle Reader Service No. 205.

POLYPHASER

The newly formatted 1992/1993 PolyPhaser product catalog of lightning arrestors and grounding devices is now available. This edition contains new products and a revised "Lightning Protection Information" appendix. Pricing is Included. To request a copy, contact *PolyPhaser Corporation, Customer Service Department, P.O. Box 9000, Minden NV 89423-9000; (800) 325-7170.* Or circle Reader Service No. 206.

PLANNED PRODUCTS

Planned Products has introduced a new version of the popular 2200 Circuit Works Conductive Pen. The new Micro Tip Circuit Works Conductive Pen incorporates an improved tip design and enhanced silver conductor for drawing fine-line silver traces with increased precision and control.

The new pen is used primarily to repair conventional and surface-mount circuit boards and is well suited for use on membrane and flexible circuit technologies. The improved Micro Tip design uses an easy-flow, no-clog tip for drawing precise conductive silver traces in electronic design, prototype and repair applications, including trace repair, circuit modification and component shielding.

It uses an improved silver conductor featuring the better conductivity and adhesion required by demanding design, prototype and repair applications. The silver conductor dries in five to ten minutes at room temperature and reaches maximum air dry conductivity in 20 minutes. Repairing a typical damaged circuit trace requires 15 minutes and shows resistance of 0.01 ohms or less after the repair. Maximum conductivity and adhesion occur after a heat cure of between 250-300°F (121-149°C) for five minutes. Heat-cured silver conductor can be soldered at temperatures below 350°F (177°C) using tin, lead or silver solder. The new silver conductor is safe for circuit plastics and metals including copper, solder and solder mask.

The suggested retail price is $10.95. For more information, contact *Planned Products, 303 Potrero Sreet, Suite 53, Santa Cruz CA 95060; (408) 459-8088, Fax: (408) 459-0426.* Or circle Reader Service No. 207.

NEVER SAY DIE

Continued from page 4

person—and so am I—and so are a hundred thousand other *73* readers. One thing I think you do recognize: If a hundred thousand people decide they're going to do something, the chances are pretty good they're going to get something done. And if you'll take the time and effort to convince just one other person, that's two hundred thousand—and we have a movement.

"Do It Yourself" Reviews

The next time you buy a piece of ham equipment, how about keeping notes on your experience and sharing it with the *73* readers? I'd like to know what your experience is when you get something new. I'd like to know what problems you have with it—what fun you've had—how you've solved the problems—how difficult or easy it was to get going—what information sources you've found to help—what accessories—you know, all the things you'd tell a friend.

What kind of equipment? My interests are the same as yours—I want to know about anything you buy—a transceiver, an HT, a packet unit—heck, even information resources. Before I make a buying decision on something I'd like to know a little more than I can find in the ads, or even equipment reviews. With so many competing products, I'd like to have the benefit of other people's experience.

I've just started a new publication in the music field which is based primarily on the readers sending in their reviews of the CDs they've bought. I want to know when a reader finds a CD which they think is great—and when they are disappointed. In the past reviews have always been written by music professionals. Unfortunately, this has tended to result in pedantic exercises, aimed more at exhibiting the profound knowledge of the reviewer than in help for potential buyers.

Yes, this is likely to result in a lot of much less educated evaluations. Well, I'll take that into consideration when I read 'em—and I'll be looking for more than one review on newly released CDs. I don't go to the movies just on the advice of Siskel. I also pay attention to Ebert, Medved, Lyons, and other reviewers.

So if one opinionated user review of a new HT is thumbs down and another is thumbs up, I'll want to read more and find out what it was that influenced each of the reviewers. How much is a particular reviewer blowing things out of proportion? And if the equipment is something I've had experience with, I'll want to write and set the record straight.

The end result of all this should be to help us all buy new equipment with greater confidence. When I read about a chap who's just bought a 6 meter rig and is having a ball, I'm going to want to get one too. Ditto 2 meter SSB. But suppose we start seeing complaints about a new rig—should we sweep these under the table and hide them? I think the industry as well as the *73* readers will be much better off if complaints are aired. I know I'll have more confidence in what I'm reading as well as in the company which faces up to and solves problems.

So the next time you buy some ham gear keep notes on your experience and send me a letter telling me how it worked out. If you have problems, be honest about them. Let's not get into histrionics. Yes, of course I'll be in touch with the manufacturer to try and help resolve problems. So don't get mad; let's instead try to find out what went wrong and why, and get it fixed. Address your letters to Vox Pop, *73 Magazine*, 70 Route 202 North, Peterborough NH 03458.

I'll be much more influenced in my buying by a few letters telling me how great something is than by a formal equipment review. It's fun to buy something new and get on the air with it. The main thing holding me back is a lack of information. So, when you find something that's particular fun, start writing so you can share it with all of us.

An ARRL Proposal

The ARRL and W5YI have proposed that the volunteer examiners take over all Novice exams as well as those for higher license grades. Well, sure, why not, right? So what are the benefits? And what are the drawbacks?

The benefits are easy to see. The VECs will about double their take. It's more difficult to see any benefits to prospective Novices. So difficult that, even with my legendary imagination, I'm stumped. Of course, since no VEC is really interested in the fees, their main goal being to provide a service, doubling their business would just be a nuisance.

This system would make it far more difficult for Novices to get examined. The present arrangement makes it so any radio club can handle this. So let's scuttle this proposal. Please let the FCC know you think this is a bad idea.

KV4FZ Convicted!

Will Herb's conviction of phone call theft cool the mess on 14.313? Herb, the Chief of Police Communications on St. Croix, has been convicted of stealing and using telephone access codes while making over $1,000 in long distance calls. Many of these calls, it turns out, were devoted to Herb's special amateur radio interest of trying to destroy our hobby. He and his group of mentally defective deviates must be congratulated on a bang-up job of trashing our 20 meter band.

The problem we have is that while it's pathetically easy for people to get ham licenses, it takes almost an act of Congress to take one away. There's something wrong with that whole concept. I don't think the founding fathers put anything in the Constitution guaranteeing us the right to a ham license. It's a privilege, not a right. Well, there are responsibilities that go along with privileges and the rest of us are hurting because we have no way to protect our privileges from being trashed.

Granted, there's not a lot that we as individual amateurs can do, and that adds greatly to our frustration level when we hear the crap we have to put up with. The thought that comes to my mind when I hear all this nonsense—when I hear the bad language and racial taunts on 75m—when I hear dirty jokes—is why isn't our only national amateur radio organization working with the FCC to do something about this? Well, I've been watching carefully, hoping to see some signs of even a faint interest in the problem. Nothing visible yet.

I keep wondering how many amateurs have asked their ARRL directors to take some action on the growing messes we are hearing on our bands. The directors are presumably visiting your clubs and are there for you to demand action. If there's been one single case anywhere in the whole country where one single amateur has stood up at a club meeting and asked a director to take action I have not seen it reported in any club newsletters, nor have I had letter one from anyone claiming to have asked. I can only surmise that no one really gives a damn. Oh, I hear hams bitching and kvetching about it, and many letters grumble to me about it, but I have yet to hear of any time anyone has actually done anything. So much for a sense of personal responsibility.

So what can be done? Well, keeping in mind that a ham ticket is a privilege, how about getting the FCC to institute a simple system for de-licensing offenders—something which doesn't require hiring lawyers and going to court? Let's make it easy to rescind the privilege and stop considering the license as a right.

We need a system which we can run ourselves, without having to bring the FCC into the action. The less money we cost the FCC, the longer we'll be around. We know how to find hams causing intentional interference. We know how to tape the offenders. So let's empower our ham clubs to not only issue Novice licenses, but also to take away licenses.

We've been able to establish repeater councils and handle our own channel allocations, so why not set up a defrocking system? I'd suggest we establish area ham club councils to deal with this kind of mischief. If we let individual clubs have full say, we could run into problems with renegade clubs. Indeed, there are so many ham idiots in Southern California they probably could form several clubs. I don't think the bad guys outnumber the good guys yet—even there.

As you can see, when there are civil problems I tend to turn to the people for solutions, not to government or officials. The best rules we've had in amateur radio have been those we cooked up. The worst have been those from the FCC. I don't see any signs of that changing. And yes, the most disastrous of all, by a wide margin, have been promulgated by our own ARRL bureaucrats—like the 1963 Incentive Licensing disaster.

My apologies to any subliminally brainwashed ARRL members who find their bowels in an uproar over my admittedly rare mentions of that esteemed organization. The League has always promoted the concept that only League members have a right to criticize the League. Well, I've got my 50-year ARRL membership plaque, so I have every right, within the ARRL framework, to make suggestions and carp.

QSL of the Month

To enter your QSL, mail it in an envelope to *73*, Wayne Green Inc., 70 Rte. 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subcription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRP

Number 22 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW,
Massillon OH 44646

The Radio From Hell

I'm a beaten man. Yup! I'm not one to give up, but after a week and a halt, you can stick a fork in me. I'm done! The reason for all of this is a simple direct conversion receiver slated for 10 MHz. Nothing really complex, just an NE602 and some 741 op amps. As it turned out, I created the radio from hell. On this project, I'm not a happy camper. Learn from my mistakes.

The problem started with the VFO. Using a MPF102 in a Colpitts oscillator seemed like a good idea at first. The output of my Colpitts oscillator feeds the NE602 mixer with more than enough output. Excessive injection can cause all manner of critters to come out of the NE602. A small value capacitor couples some of the VFO energy to the NE602. A T50-6 core and several small-value caps comprise the tuned circuit for the VFO. Now, I'm not one for re-inventing the wheel, so I used as my starting point the VFO from one of the projects in "W1FB's QRP Notebook." Using the values listed for 30 meters, I began winding coils and heating up the soldering iron. I built the VFO first on a small piece of perfboard. Try as I might, I could not get the VFO to oscillate. Zero! Zip!

The silly thing would not even oscillator on the wrong frequency, let alone on the desired one. Out came the frequency counter and the oscilloscope. Try as I might, the oscillator still wouldn't fly.

The circuit is drawing current, so something had to be running. I checked the voltage on the drain of the MPF102 and, sure enough, I had the regulated voltage from the 7.5-volt zener diode. Yes, all the grounds were grounded and all seemed right with the world; but alas, no go.

A bad MPF102 must be the trouble. I replaced the MPF102 six different times. I gave up on number six as the chance of getting half a dozen bad FETs is a bit high. So, I started to replace the capacitors in the circuit. Again, nothing I did seemed to bring any life to the circuit. A desperate man, I scraped out the toroid and its capacitors from the circuit and in its place I installed a crystal cut for 10.106 MHz, one that should oscillate like mad.

Nothing but six zeroes on the counter. It was a little after three in the morning. The final score: VFO three, Mike zero.

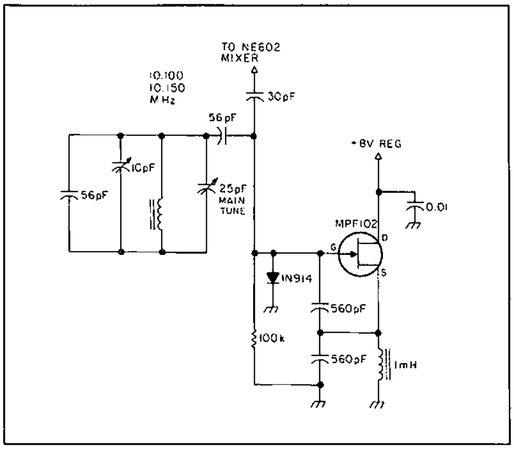


Figure. The oscillator from hell.

The Next Attempt

The next night (good thing I work 3-11 most of the time) I was back in the saddle again. All day long at work I had been working on the problem in my mind. And, as many have said, there is nothing up there to get in the way of an idea. I was out for blood, and the victim was the VFO.

My usual cut-and-try method was simply not cutting it (ouch)! I needed to get serious with Mr. Calculator. Out came the books, piles of books. If nothing else, perhaps I'd scare the oscillator into working. Look at the schematic in Figure 1. This is the beast I have been working on. The values listed are the ones I started out with.

Since I did not know the value of either the variable capacitor I was using, or the size of wire I wound the toroid with, Mr. Calculator was of little help. The variable capacitor looked as if it should be about 50 pF or so, and the wire looked close to #24 or #26 gauge.

It would seem to me that even if the component values were way off, the thing should still oscillate somewhere; but it didn't. So I started to remove components from the receiver. Perhaps I'd gotten a bad NE602? A shorted IC socket perhaps? I replaced the coupling capacitor several times thinking it might be bad. I also changed the values of the coupling capacitor. After awhile, I just removed it altogether and let the output of the VFO dangle there with my frequency counter probe attached.

Back using the cut-and-try method, I found (by changing out either C2 or C3 or both to 330 pF) I had a working VFO. The frequency oscillated from 9.500 MHz to 11.900 MHz. I could change the working frequency of the VFO slightly by spreading or compressing the turns on the toroid core.

Even though the VFO was operating, it was not a working unit. No matter what I did, I could not get smooth linear tuning from the VFO's main tuning capacitor. I could tune all the way from 9 MHz to over 12 MHz! This was all being done with a small 50 pF capacitor. The score for this evening: VFO four, Mike one.

I also found out that if I changed the values of C2 and C3 up or down ever so slightly, the oscillator would stop. One would think the frequency would either be raised (by using smaller value capacitors), or be lowered (by using larger capacitors). I found out that such is not the case with this circuit.

One More Try

Really drawing for straws, I decided that the main VFO capacitor must be way off its marked value. Nope, I don't own (yet) a capacitance checker, so I started to pull out the rotor plates, one at a time. This would lower the overall capacitance of the tuning capacitor and thus give me more band spread. Maybe instead of 50 pF the capacitor was really 500 pF. When I got down to the last rotor plates, that theory went out the window: I had a variable capacitor with one rotor plate and still the frequency went from 9.98 MHz to over 11 MHz.

So I re-wound the toroid core by adding thicker wire and five fewer turns than I had before. I removed the small 10 pF trimmer capacitor in parallel with the main tuning capacitor—perhaps too much capacitance was causing the problem with the band spread. Well, that idea was way off base too. I had a VFO all right, but still not where I wanted it to oscillate. So, I tried padding down the tuned circuits by adding small capacitors in place of the trimmer. Using 10 pF caps, I kept adding them to lower the frequency of the VFO. Now instead of running at 9 MHz something to over 12 MHz something, I had it tuned between 6.8 and 7.7 MHz. Could it be I had it beaten? Well, Kenwood has their DSP, Ten-Tec their QSK and Yaesu their CAT system. I just developed VBFC, that's Variable Band Frequency Control. Yes Sir! All you have to do is start on the high end and turn her on. In no time you'll cover the entire 40 meter band in 50 Hz steps.

I connected the VFO to the NE602 and while I'm sitting here typing this, I'm listening to all of 40 meters all at the same time. Whoa! There goes CHU Canada. Sure wish they were on long enough so I could set the station clock. Perhaps during the next sweep I can set the clock.

So there you have it, two weeks down the tubes working on a VFO. Final score: VFO eight, Mike three. But as Arnold Schwarzenegger likes to say, "I'll

RTTY LOOP

Number 23 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Thanks To and From our Readers

I will start off this month by recognizing an anniversary. This column marks the start of the sixteenth year of "RTTY Loop." I don't know for sure, but I think this ranks up there with Wayne's "Never Say Die" column for longevity. All I can say about that is "thanks." Thanks to you, the readership, for your support and letters. Thanks to the crew at *73* for all their support and encouragement. Thanks to my family, for their understanding of this crazy hobby.

First of all, some follow-up on the column on America Online. When I checked, in late April 1992, the Kenwood file shown is available. Just look in the amateur radio files for the IBM PC compatibles. Also, I continue to be happy to forward your name to the service for starter software. Users of Macintosh or Apple II systems, please so indicate. Users of PC compatibles will need an EGA screen or better, mouse, and hard drive. Let me know the floppy disk size (5" or 3") you use.

Now, a message from Terry Stader KA8SCP/1, the America Online Ham Shack Host. He says, "It was nice to see the America Online's MS-DOS Ham Library graphic in the March 1992 issue of *73 Amateur Radio Today*! Thanks for picking us out of the rest (Delphi and CompuServe) as one of the best bets. I think that the ham shack area is on the move with more and more personable interaction with the users than all of the other services combined! Our libraries are growing every day! Recently, a quick survey showed that many of our hams are interested in RTTY. Many of them know nothing about it . . . other than it is a mode that is available on the multimode TNC!"

Another member of America Online, Willie WD9FHA, passes along "a short note to let you know how much I enjoy 'RTTY Loop.' I read it every month. I am not on RTTY or packet yet. I have a Kenwood 7400A for 2 meters and a TS520S for HF. I am not sure the 520S would do very well on packet, but I may try 2 meters soon. I have a 286 clone so that will help." It's good to hear from both of these folks, and it points out how broad-based amateur radio communication has become. On and off the radio, we do get around!

Help Out a Hamsoft User

Now, turning from some of the latest communication to an orphaned machine, I have a letter here from Charlie Anderson KG5SX, of Hattiesburg, Mississippi. Charlie wonders if we have addressed the Kantronics Hamsoft cartridge for a Texas Instruments TI-99/4A computer.

He relates, "I have used one of these for several years now, and it performs well and fills my bill for RTTY operation as I use a Heath HW-101 for 60 wpm RTTY and occasionally 100 wpm. My old Heath would not have the fast turnaround time required for AMTOR, so I am content to stay in the slow lane.

"Now I have a problem that I hope someone can help me with. It seems that I made a mistake in the shack one day and got 120 volts AC on the ground buss of my computer. Before the fuse blew the computer did, and took out part of the Hamsoft cartridge as well. The computer was easily enough replaced but I am having trouble locating another Hamsoft module. The cartridge may be OK, but [I am] not sure, as it locks up the computer when I try to use it. Sounds hopeless, but there is a chip in the cartridge that I do not have the number for, as the top of it is gone, and this chip appears to have taken the brunt of the shock. It is an SN74??? series chip. These are the only numbers readable on it and it is tied into the TMS9901 chip on the board. The ROM chip, which is marked HN482764, appears OK visually, but I know it may be permanently damaged.

"I called Kantronics and they said that they had nothing left on this device. No parts list. No schematic. They referred me to Dentronics and I called them and got the same reply. I have tried to locate a used cartridge via the 1-800 numbers, but have been unsuccessful so far. I really want to get this thing fixed or replaced, as it was on loan to me and I hate to tell my friend, 'Sorry about that, ole buddy!' I know it is a long shot, but hopefully the only thing wrong is the 14-pin DIP chip . . . and maybe the TMS9901, which I know where to locate. [Hopefully someone] can look inside [a Hamsoft cartridge] and tell me what the chip number in question is. Or perhaps there is someone out there who can clone me another ROM chip, as mine is QRT."

Well, the reader base of this column is one of the most complete in the RTTY universe, Charlie. So, if anyone has the information, please forward it here, or directly to Charlie. We all thank you!

By the way, reversing the AC line hot and ground wires can be more than damaging to computers; it can kill you. If you touch a chassis that you think is grounded, but is really at full line potential, while touching a real ground, the result could be a real silent key. One simple device which can help is a $5.95 Grounded Outlet Analyze, available at your local Radio Shack (stock number 22-101). This handy little plug-in device has color-coded lamps to indicate whether or not the outlet is correctly wired. No, it may not be the equivalent of industrial testers costing hundreds of dollars, but it doesn't cost hundreds of dollars, either!

Packet Without a TNC

Interest in TNC-less packet is well articulated by many of you, with a common set of questions. David L. Ringo, M.D., N6UVF of Portola Valley, California, is one such interested party. Just finishing his psychiatry residency, Dr. David finds interest and intrigue in the different digital modes. "The possibility of putting together a very compact laptop/2 meter HT packet system is very attractive, but a number of questions come to mind. As I understand it, the BayCom and PMP *['Poor Man's Packet,' August 1991, 73]* systems differ in that one uses the serial port and the other the printer port, so that one's modem would be incompatible with the other's software. What's the real scoop on TNC-less systems? Are they as effective as a TNC, and if not, what exactly are the trade-offs? Are there significant differences between the German and A & A BayCom modems? Do you have any recommendations as to suitable laptops? I would think that RFI from the computer would be a significant issue, but I haven't seen anyone address that."

First of all, I agree that a serial and parallel data flow are incompatible. This is not to say it has not been done, just that I don't think one modem will suffice for both systems. The TNC is, after all, a dedicated computer that performs all the functions necessary for packet communication. Your personal computer can do the same, but the overhead for managing local operations, video, disk access, printing, and the like, would all cut into packet time slices. I would say that for routine, straightforward packet work, the TNC-less systems may well be all the typical amateur needs. For more demanding work, to set up a digipeater or bulletin board, the efficiency of a dedicated TNC would be a requirement. As to the differences between BayCom modems, I can't say. I would invite users' comments, though, on the various implementations, and will pass them along in future columns.

Suitability of laptops hinges on several factors, but FCC Class B certification, attesting to the lower RFI levels for home computing, is an ABSOLUTE! Other than that, the best bet would be to stick with one of the national brands, and even with a local dealer who will allow you to return or exchange the machine if RFI is a problem. I don't yet own a laptop, or I would share my own experiences. Don't fret, though, my history of candor is that when I do pick up a new piece of hardware, I share the information with a few of my most trusted friends: YOU.

Next month, more from here and there, you and me. The one story I won't tell you is how a squirrel brought down my antenna (unless you really want to hear it). I continue to look forward to your input, both by mail and Email, via CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR) and America Online (screen name MarcWA3AJR).

HAMS WITH CLASS

Number 24 on your Feedback card

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Invention Versus Innovation

If, as a teacher, you were given the following background information about one of your new students, what assumptions would you make about his abilities to be successful at anything?

"The doctor said he had brain fever at birth—having an extra large head. In fact, three brothers and sisters died at birth. Relatives and neighbors thought he was abnormal, but his mother said no. His teachers thought he was abnormal too, so his mother taught him at home. He was a firebug, setting a fire in the barn just to see what it would do. He had only three months of formal schooling."

As any good teacher can tell you, it's not a good idea to make any assumptions about any child's ability to succeed until you've had a chance to work with the student yourself. The fact is that the young man described above is Thomas Edison!

We who are teachers or instructors must be careful not to pre-judge anyone who sits before us. It is a truism of education that given the right environment and motivation, everyone is capable of doing at least a little better than his own expectations. I've been working with young people for almost 20 years, and *I* certainly believe that.

Those of us who are working hard to promote growth and quality in amateur radio know the value of encouraging newcomers to explore and experiment with different modes of communication. We who are in the classroom are in the position of being mentors who can actually teach children not to be afraid to take risks; not to be afraid to ask questions and to be curious; and most importantly, not to be afraid to fail.

While it is true that we're not all going to have a Thomas Edison in our classes, we are all at least going to have some youngsters with the potential for being creative and innovative, if only given the chance. When you tap into someone's creative psyche and give them the tools they require to take a chance, you never know what great ideas, inventions or innovations you may be setting into motion.

The History of Invention and Innovation

Firstly, the children should understand the difference between invention and innovation. An *Invention* is a brand-new and unique idea or discovery. An *Innovation* is a concept that builds on a previous idea, invention or discovery, providing a new or perhaps improved solution.

Many thousands of years ago our ancestors found that daily living was a pretty rough experience. The caveman had only his hands to use for hunting, fishing, and gathering plants and roots. He had to find creative ways to protect himself and his family from the elements (the weather and the wild animals). Early man was forced by circumstances to use his brain and his hands to make things that would make his life easier and more pleasant. He invented tools for fishing, hunting and building. At first the tools were just sharpened stones. He soon discovered that fire was good for keeping warm and that water had many practical uses. The fur from wild animals proved to be valuable for warmth, so clothing was invented. Most likely it was a rolling rock or a cross section of a tree trunk that began to slide and roll which gave someone the idea for a wheel. One invention led to another. Many men thinking and inventing over a long period of time led to some of the inventions and innovations we have come to rely on today.

In prehistoric times there were no chairs. Our ancestors probably leaned against the cave wall or sat on a rock or a ledge. At some later date, the chair was invented. Since that time, thousands of different kinds of chairs have been designed. Today there are all kinds of chairs: folding chairs, rocking chairs, lounge chairs, couches, beach chairs, etc.; all these different kinds of chairs are innovations. They each meet a different need based on the original invention of the chair.

Teaching Techniques

A good activity to use in the classroom is to have students make a list of commonly used devices. Then have a discussion about which category each item belongs in—invention or innovation. A good follow-up to this is to divide the class into groups and have them brainstorm about one particular invention. It's sometimes helpful to have children work together in a group to get started with this kind of creative process. After they've researched all the background on a particular invention; like who the inventor was, why it was invented, what needs it met, when it was invented, etc.; they can make a list of possible innovations for the future. Children tend to be less inhibited with the creative work when working as a team. Besides, working as a team member is an important skill to master. Many inventions and innovations that are made nowadays are made by employees in large institutions who are part of a research team.

One year we turned an entire complex of rooms in our school into a living time line. Each room represented a different era of time in history. When a visitor walked into a particular room he was transported into a time warp. The children wore costumes of the time, served food of that period, and exhibited inventions of that era. What a fabulous activity this can be in a school! There were so many subtle lessons learned—like the fact that there were certain periods of time that were more conducive to the spirit of "inventing" than others. Why? The Time Line Fair lasted only three days, but the preparation for it took weeks, and the follow-up discussions and lessons went on all term. I strongly recommend that you include a living time line activity in your curriculum.

Another good activity to encourage creative thinking is to have the youngsters keep a diary over a period of time of all the needs and problems that they encounter.

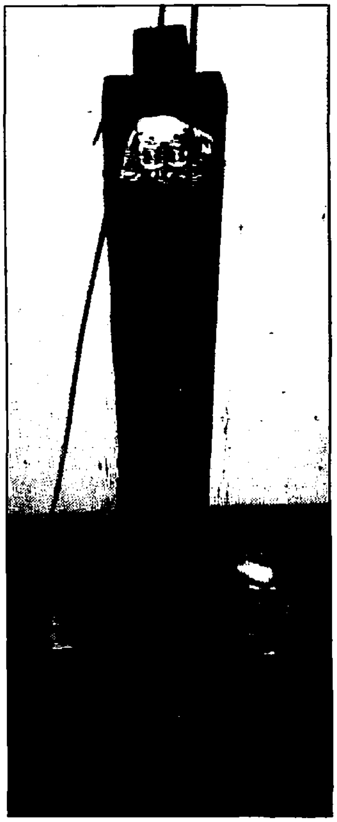


Photo B. This is the replica of the fire alarm W2SLP invented as a young boy.

Most inventions and innovations come about from a need or a necessity for change. Let each child pick a need or problem and lead a brainstorming session to see what kinds of solutions the rest of the class can come up with. You will be amazed at how productive these sessions can be. I even tape-record some of the more sophisticated topics so the children can refer back to the things that were discussed.

I'm a strong believer in bringing in experts who are good speakers to meet with the children in person. After you've laid the groundwork for the class's involvement with their own inventions, you might want to invite a patent attorney to visit

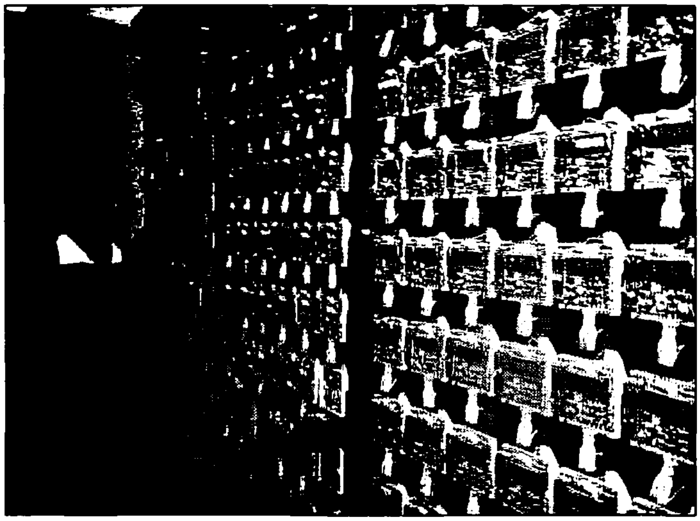


Photo A. Roger W2SLP testing circuit boards for a digital clock thermostat he invented.

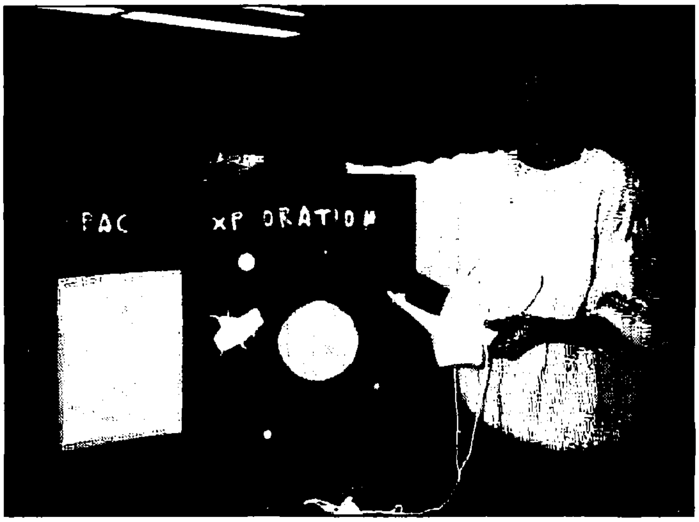


Photo C. Frank KB2MID "invented" a remote-controlled shuttle to fly around his space station. Carole WB2MGP encourages her students to be creative with their projects.

your school. Once the children get caught up in the spirit of "inventing" they will have a million questions for this kind of expert about what they can do next with their inventions.

Bring in Your Ham Friends

Think through your list of ham friends and you'll probably come up with someone who has tinkered with a new kind of gadget, invented a new gizmo or discovered a better process for doing something or other. Bring them in to speak with the kids. Let them share their thinking, their methodology, and most importantly, their enthusiasm with your students.

I'm lucky enough to know several hams who fit this bill. My good friend Roger Isaacs W2SLP owns an electronics manufacturing company on Staten Island. He is the inventor and patent holder of several terrific products, including an electronic clock thermostat, a wireless car alarm, and various versions of fire and burglar alarm systems for stores and houses.

Roger once took the time to recreate a project he created as a child for my class to see. As a youngster he thought up his own version of a simple fire alarm by building a "Rube Goldberg" kind of device. When you light a match under one of the wires, it releases a magnet which drops down to close a circuit which then enables the bell to ring. The kids love it!

Don't forget to include enrichment activities from the social studies curriculum. Many inventions greatly influenced the course of history. Doing research on inventors throughout history is a valuable lesson. It can lead to discussions about how our lives might be different today without the work of people such as Guglielmo Marconi, Jonas Salk, Charles Goodyear, Louis Pasteur, Robert Goddard, Johann Gutenberg, or George Washington Carver, just to name a few.

Several months ago on our CQ All Schools Net, Jay Apt N5QWL, a NASA astronaut, was speaking with some 6th grade ham radio students of mine. He asked a youngster to go to the chalkboard and make a list of all the things the class thought should be part of the astronaut's spacesuit. This naturally triggered off all kinds of terrific discussions and research projects for weeks about space travel and astronauts and communications devices. What Jay was doing was setting the stage for this creative thinking we've been talking about.

My advice is to approach every class as though you believed there must be a future Thomas Edison amongst the children, who would emerge if only you could create the right atmosphere for him or her to flourish in. Amateur radio in the classroom makes this not only easy, but fun as well. Good luck, and let me know what your kids and you "discover."

A good resource to write to for more classroom ideas about inventing is "Invent America," 510 King Street, Suite 420, Alexandria VA 22314; or call (703) 684-1836. 73

Number 25 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

I have just come home from a very satisfying experience, seeing 38 non-hams show up for a meeting that was the start of a Novice/Technician class in Keene, New Hampshire. It was wonderful to see people of all ages, from the young to the more mature (we're never old, are we), male and female. My sons might have used the expression "AWESOME"!

There were also more than 10 licensed hams at the meeting, all willing to take time away from their families and friends to help in any way that they could to give a boost to the ham population in the Keene area. The syllabus has been laid out and many hams will take part in the teaching, not just one or two.

Something else that is very important is the location, the place where all the training will take place. One of the local hams is a member of the Army Reserve and he asked the powers that be if we could use the facilities of the local reserve unit for the ham training. We received approval from the local commander and things started happening.

How many of you have done the same thing in your area? How many of you have given something back to the hobby you love? How many of you have become an "elmer" to another person, a prospective ham? How many of you have read the Silent Key column in your favorite ham magazine or newsletter, shook your head, but have done nothing to replace the lost one with at least one more?

If your answer or answers to the previous questions lead in the direction of "Let someone else do it," or "I can't do it," you are now part of a very common problem: apathy—lack of feeling, emotion, excitement; indifference [courtesy of Webster's Dictionary]. *How about becoming a part of the solution to the decreasing ham population by getting involved locally in starting ham classes, either in the evenings at some convenient location or at some of your local schools? Many teachers/hams are doing it in schools in a very big way and doing it very well. It is a natural thing to do. We in the United States have been advised that our education system is sadly lacking in mathematics and science, and that we are last or almost last in that knowledge worldwide. Ham radio involves much more than just chatting on the radio waves. It includes many things: science, math, language, etc. What better way to help our young people learn than to get involved with them! Maybe we will learn something from them also. Let us* ***ALL*** *become part of the solution to the problem!*

Hopefully all of you are now aware of the movement of the 73 offices back into Peterborough, New Hampshire. There is a new address and also new phone and FAX numbers. I'm sure that if you have sent something to the Hancock address it will make it to the new "digs."

As I am finishing this column I am in a hurry because I still have to pack my station wagon with all of the "treasures" that I am taking to the Deerfield Hosstraders Ham Fleamarket. The usual starting time is 4 p.m. on Friday, and the event usually ends about the same time on Saturday. As of 8 a.m. this Friday morning there are already people willing to pay a premium amount to enter the fairgrounds to get a good location. This is out in the open, under the trees. There are buildings available but usually only the dealers will rent space in them to set up their wares. I guess it is what you call a "happening"."

Hopefully, many of you around the world have the same chance to attend such a happening. It is always great fun to see people that you haven't seen since the last one or meet a person for the first time that you have been talking to on the air for many years.

Maybe you will be an elmer to some new ham and help that person in choosing a first rig. Do you remember your excitement with your first rig? I certainly do, and it is now time for all of us to see the delight in others' eyes as they carry it (drag it?) back to their car. As I mentioned before, become part of the solution to the dwindling numbers of hams in the world, ***GET INVOLVED!***—*Arnie N1BAC*

Roundup

Netherlands Just received is the first edition ol "On Target," a free publication designed lo inform listeners about what is happening lo the English language programs from Radio Netherlands. This newsletter is sent twice a year to listeners who have registered on the mailing list. Radio Netherlands is making a lot of changes to the format of its transmissions, bringing the presentation in line with a new style for the 1990s.

If you wish to receive this free publication send your name and address to: "On Target," Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, The Netherlands; FAX: +31 35 724 352. If you have signal reports you wish to send, address them to Monitoring Panel OTR, Radio Netherlands Frequency and Monitoring Department, at the same address.

Scotland From John "Paddy" McGill GM3MTH: The Scottish Tourist Board (Radio Amateur) Expedition Group event for July is GB2SMC at the Scottish Museum of Communication, Bo'ness, July 18/19. *[Check the May issue for frequencies and times.—Arnie]*

United States/Nepal Information received on the packet system from Bob K1RB, 16 April 92, 0100Z: "Gary Olson KA9RLJ has confirmed that Father Marshall O. Moran 9N1MM passed away early today, al a hospital in Katmandu, Nepal. The sad news followed word that Father Moran was hospitalized by what was believed to be congestive heart failure several days ago. Father Moran was often on the '256' net until recently. A member of the Jesuit order, Father Moran had friends all over the globe. From his station in Nepal he communicated with amateur radio stations worldwide. He made many trips to the United States, attending numerous amateur radio gatherings." *[Father Moran will be sadly missed by all hams around the world.—Arnie]*

United States/Ukraine From Mark Olesnicky N2DQS: On September 2, 1991, I made contact with a strange callsign in what was at that time still part of the Soviet Union. The callsign was RY75BL.

I inquired of the station, and found out that this was a Special Event Station in the Ukraine commemorating the 75th anniversary of battles between the Ukrainian Sitch Army and the Tsarist Imperial Armies held at the site of this station atop the hill Lyson near the city of Berezhany in the Ukraine (Zone 16, Oblast 076).

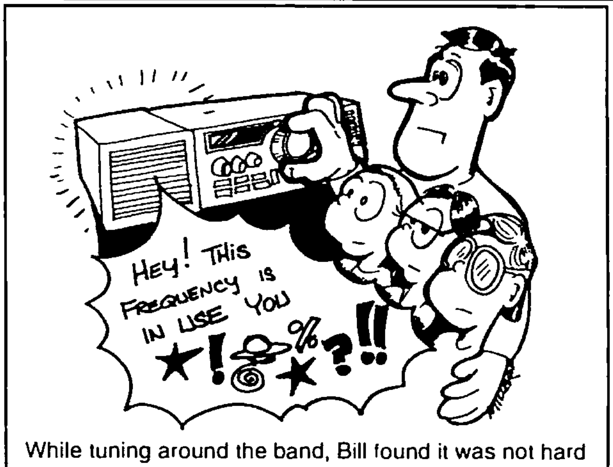
Although they spoke English well, I switched to the Ukrainian tongue and had a wonderful QSO with the organizers of this Radioexpedition to the hill Lyson. It was organized by the Club Station UB4BYU, a group of young students at the local technical school. The club trains and inspires youngsters in the art of amateur radio and invites other groups such as Scouts, known as "PLAST" in the Ukraine, to participate. They slept in tents, ate food supplied by a field kitchen, and transmitted from transceivers powered by batteries or generators. This Field Day atmosphere inspired great camaraderie and a sense of pride and accomplishment for this group of young Ukrainians. As you may recall, the Ukraine had just announced its independence a short time before.

As one of the leaders, Ihor Hrycyszyn UB5BBN explained to me that the emphasis of this expedition to Lyson was on youth, their pride of national origin, and the hope of being recognized by their international peers. From August 30 lo September 4, 1991, they had 4,500 QSOs with 92 countries.

To confirm and commemorate this QSO and event I received a beautiful diploma and several QSL cards, as well as personal letters and copies of newspaper articles describing the event.

Today I received a letter from Ihor UB5BBN informing me that Special Event Station US76BL will be on the air from 0000UTC on August 28 through 2359 UTC September 2, 1992. The call stands for Ukraine Sovereign 76 Berezhany Lyson. The number 76 is for Oblast 076.

The organizers of this Special Event Station request that I notify anyone who could make it a resounding success. Operation will be on all bands and will include CW, SSB, RTTY, and SSTV. To receive a QSL and certificate of the event (Diploma), one must complete a successful QSO with US76BL and send a QSL card along with 5 IRCs to: Ukraine, 283150, Berezhany, Ternopilska Obl., p/s 12 UB4BYU. *[Mark T. Olesnicky, M.D., N2DQS, 9 Driftway, Florham Park, NJ 07932.]*



While tuning around the band, Bill found it was not hard to hold the children's interest during the demonstration.

Number 26 on your Feedback card

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The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

Deadline for the August classifieds is June 11, 1992.

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Number 28 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

If It Ain't Broke . . .

The ARRL and Fred Maia W5YI have, for reasons we will try to fathom, decided to fix something that isn't broken–Novice licensing. This is business as usual for the ARRL in their goal of total dictatorship over American amateur radio, but I haven't a clue what deal W5YI was promised in order to garner his support for this absolutely unnecessary and regressive proposal.

Tens of thousands of hams, including yours truly, were introduced to amateur radio through the current form of Novice testing. In my case, it was a high school amateur radio club. I attended after-school license classes for a couple of weeks, and when the club advisor thought we were ready, he and another ham-teacher administered the Novice exam to us. No trips to the FCC office in Boston (this was pre-VEC days), no unfamiliar surroundings or strange and different sounding Morse code test. My "elmer" guided me through the learning process, and he had the reward of seeing his efforts result in many proud young Novices.

The ARRL and W5YI would like to change all that. They have proposed to the FCC that all Novice testing be incorporated under the VEC program, and we must let the FCC know in no uncertain terms that the amateur radio population sees this for what it is: another blatant and self-serving power grab.

The ARRL and W5YI offer that their proposal would cut down on incorrect Novice license applications, thereby saving the FCC the time and expense of processing these forms. Boy . . . doesn't that sound peachy? All they want to do is help out the FCC, thereby saving time and money. How could anyone disagree with that?

Who said there was an unusually large amount of time and money being spent to deal with faulty Novice exams? Where is the research to back up the claim that this is a problem? If there is a problem, why hasn't the FCC ever mentioned it?

For sure, a certain number of Novice exams are bound to be submitted with examiner errors. Does the number of examiner errors justify eliminating a program that has been instrumental in gently introducing two generations of young people (not to mention the thousands of older hams) to amateur radio? The Novice test and license application is not quantum physics. It doesn't take a rocket scientist to correctly administer and submit a Novice exam. Could clearer instructions take care of the problem (if one *does* exist) of examiner mistakes?

Another reason given for adopting this proposal is to cut down on fraudulent Novice testing. I wasn't aware that there *was* any great amount of Novice testing fraud. Boy, I'm sure glad the ARRL and W5YI, who obviously consider themselves more honest than you or me, are going to save us from the hoards of illegally tested Novices. Oh . . . you mean you weren't aware of the thousands of fraudulent Novice licenses granted every year? Gee, now that you mention it, this is the first I've heard of it, too. (Let us not forget that the only testing fraud in recent memory was perpetrated by duly authorized VEs.)

If no problem exists, then it follows that the ARRL and W5YI must have some other motive behind this nonsense. I haven't a clue why W5YI would support this proposal, unless it's part of some deal that is yet to be disclosed between Maia and the ARRL. I admit that this is pure speculation on my part, but I can think of no other reason why an otherwise intelligent guy like Fred Maia would back such an idiotic proposal.

The ARRL's motives are more apparent. They are the same motives that guided the ARRL when they wanted to control all licensing by being the *only* authorized VEC (luckily, the FCC kept that from happening). They are the same motives that made the ARRL suggest that they handle all special callsign allocation. When the FCC said they wouldn't mind having a program like the VEC system handle special callsign requests, but that the ARRL was not going to get a monopoly, the League backed off and made the FCC look like the bad guys. Once again last fall, the ARRL's motives became clear when—without notifying their members, or the entire population of American hams they *say* they represent—they had wording added to an FCC funding bill that would give them exclusive power to assign special callsigns to radio clubs. (Coincidentally, it was W5YI who blew the whistle on the ARRL's sneakiness. Hmmm . . . that might lead some to wonder if we'll be seeing a joint ARRL/W5YI callsign allocation proposal in the near future.)

Can anyone question what the ARRL's prime objective is in proposing to get Novice testing out of the hands of your average ham? Don't you see a pattern here, folks? For the last 25 years, the ARRL has consistently and systematically tried to become the sole governing and regulatory authority for American amateur radio. If the ARRL was capable of acting in the interests of amateur radio, I'd be the first in line to give them more power and authority. But the League has proven time and again, by their own actions, that they are not concerned as much with the hobby of amateur radio and the concerns of the average ham as they are with their own self-serving agenda and self-perpetuation.

I urge you to write to the FCC in Washington and voice your opposition to this proposal. While you're at it, why not drop a line to the boys in Newington and let them know that the majority of American hams are happy with the way the Novice license test is administered.

Instead of creating a transparently obvious paper tiger out of Novice testing, why doesn't the ARRL spend some of its sizeable bank account to help educate the country—especially youngsters—on what amateur radio is, how much fun it is, and how to get involved? Until they do, the majority of hams in this country won't have anything to do with them.

This Novice testing proposal is just another piece in a long line of evidence that shows the ARRL is more concerned with what is good for the ARRL than with what is good for amateur radio. 73

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

In general, you can expect July to be a month of reasonably good conditions on the HF bands, with minor disturbances centered around the 9th, 17th, 22nd and 25th . . . leading to Fair or Good-to-Fair conditions. You can expect considerable short-skip opportunities during the daytime hours on bands between 20 and 10 meters. DX this month will experience the usual summertime slump, although most HF DX bands will be open during daylight hours, and usually until dark, with the highest frequencies dying first, followed by 20 meters last. Then, during hours of darkness, the bands between 160 and 30 meters will tend to come alive. The "top" band (160 meters) will be best between local midnight and 6 a.m. for DX contacts and contacts around the U.S.A. Eighty, 40 and 30 meters will be best in evening and early morning hours. Notice that we don't anticipate any "Poor" conditions in July. Thunderstorms, typical of July, will cause considerable crash-static interference on the bands below 20 meters . . . some of which will be unstable during stormy periods. You can expect thunderstorm QRN to block out signals when the storms are located between your QTH and that of the station you are trying to work.

"Sporadic E" propagation via "floating" ion clouds in the E-layer of the ionosphere will provide extremely strong signals from time to time during the month on the frequencies between about 20 meters and 10 meters . . . possibly even 6 meter openings . . . on some Good days during the month. Sporadic E results in contacts of up to 1,000 miles or so, and is characterized by signals that last from a few minutes to as much as half an hour or so, with almost instantaneous fade-out.

Watch the charts for the best times, bands and directions for your DX efforts, and also look for WWV reports on current conditions and trends at 18 minutes after any hour. July should be a Good month in General–as summertime conditions go–but of course can't be compared with spring and fall conditions. Enjoy this generally quiet and uneventful month for portable and mobile operation, too. It's a winner. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	—	20	—	—	—	—	—
ARGENTINA	20	20	20	40D	40D	—	—	—	—	—	10	15
AUSTRALIA	—	—	—	20	20	40D	20D	20D	—	—	—	—
CANAL ZONE	15	20	20	—	—	—	20	20	20	—	10D	15
ENGLAND	20	—	15/40	15/40	—	—	—	—	—	20	20	20
HAWAII	15D	20	20	20	40D	40D	—	—	—	—	—	15D
INDIA	20D	20D	—	—	—	—	—	—	—	—	—	—
JAPAN	—	—	—	—	—	—	20	—	—	—	—	—
MEXICO	15	20	20	—	—	—	20	20	20	—	10D	15
PHILIPPINES	—	—	—	—	—	—	20D	—	—	—	—	—
PUERTO RICO	15	20	20	—	—	—	20	20	20	—	10D	15
SOUTH AFRICA	—	40	40	20D	20D	—	—	—	—	—	20D	20D
U.S.S.R.	20	20/40	20/40	—	—	—	—	—	—	—	20	20
WEST COAST	40	80	—	—	—	—	—	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	20D	—	—	40D	—	20	—	—	—	—
ARGENTINA	20/40	20/40	20	40D	—	—	—	15	15	15	15/20	20
AUSTRALIA	15D	15D	20/40	20	20	40D	20	20	—	—	15D	15D
CANAL ZONE	20	20	20	40D	40D	—	20	20	15/20	15	10D	10D
ENGLAND	20	—	40D	40D	—	—	20D	20D	—	—	20	20
HAWAII	15	15	20	20	20	40D	20	20	—	—	—	15D
INDIA	20D	20D	—	—	—	—	20D	20D	—	—	—	—
JAPAN	—	—	20D	—	—	40D	—	20	—	—	—	—
MEXICO	20	20	20	40D	40D	—	20	20	15/20	15	10D	10D
PHILIPPINES	—	—	—	—	—	—	20D	20D	—	—	—	—
PUERTO RICO	20	20	20	—	—	—	20	20	15/20	15	10D	10D
SOUTH AFRICA	—	—	40D	20D	20D	—	—	—	—	—	—	—
U.S.S.R.	—	—	—	—	—	—	20D	20D	—	—	—	—

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	20	20	20D	40D	20D	20D	—	—	—
ARGENTINA	15	20D	20	20	—	—	—	20D	—	—	—	15
AUSTRALIA	15	15	15	20	20	20/40	40	20/40	—	—	—	—
CANAL ZONE	10D	15	20	20	40D	40D	—	20	20	—	15	10D
ENGLAND	20	20	20D	—	—	—	—	20D	—	—	—	20D
HAWAII	15	15	15/20	20	20	20/40	20/40	—	20	—	15D	15
INDIA	—	—	20D	20D	—	—	—	20D	20D	—	—	—
JAPAN	—	—	—	20	20	20D	40D	20D	20D	—	—	—
MEXICO	10D	15	20	20	40D	40D	—	20	20	—	15	10D
PHILIPPINES	—	—	—	20D	20D	—	—	20D	20D	—	—	—
PUERTO RICO	10D	15	20	20	40D	40D	—	20	20	—	15	10D
SOUTH AFRICA	—	—	—	20D	20D	—	—	—	—	—	—	—
U.S.S.R.	20D	20D	20D	—	—	—	—	20D	—	—	—	—
EAST COAST	40	80	—	—	—	—	—	20	20	20	15	40

Note that a (D) will indicate a difficult path. Try on days when the geomagnetic field is quiet (G) and when solar flux is 100 and greater.

JULY 1992

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G	4 G
5 G	6 G	7 G–F	8 G–F	9 G–F	10 F–G	11 G
12 G	13 G	14 G	15 G–F	16 G–F	17 F–G	18 G
19 G	20 G	21 G	22 G–F	23 G–F	24 G–F	25 F
26 F	27 F	28 F–G	29 G	30 G	31 G	

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LETTERS

Number 1 on your Feedback card

From the Hamshack

Brent Newman, Duncan OK I was a ham wanna-be. The only problem was that I could not find information about amateur radio. After a last and unsuccessful search at the local library, I was convinced that I would never become a ham. Extremely discouraged, I grabbed a magazine off of the library's magazine rack and plopped down on the ugly green reading couch. After reading a few articles I tossed it aside and scanned the assortment of magazines for one that might be of interest to me. Then, on the last shelf near the floor, my eyes found a Godsend: *73 Amateur Radio Today*.

Before anyone could bat an eye, I had snatched the magazine from its resting place and was soaking in every last bit of knowledge from all 88 informative, interesting and inspiring pages. As I gleaned insight from your magazine, the babbling baby throwing books, the giggling girls running down the aisles, and the beautiful babe sitting across from me all faded out of my mind, making way for the most important input before my eyes.

A librarian later told me that someone donates an issue of this magazine to the library every month. "Thanks!" to whoever donates *73 Magazine* to that small library in Duncan, Oklahoma. And an especially big thanks to Wayne Green and his team for creating such an outstanding magazine.

I am no longer a ham wanna-be; now I'm a ham soon-to-be.

Bob Shafer K4IPH, Vandergrift PA I am writing to set you straight (excuse the pun) on your so-called facts. Believe what you may about homosexuality but it is not genetic nor is it incurable. Your problem stems from your tongue-in-cheek attitude toward God, our Creator. This letter is to let you in on some Good News. Jesus Christ is GOD, the Son of the Father. All things were made through Him, and without Him nothing was made that was made. He became a man, coming in flesh, born of a virgin. He died in our place, instead of us, under the punishment of God for our sins. In His death He took the penalty that we deserve. In so doing God was, in Christ, reconciling the world to Himself, imputing our trespasses to us. Jesus became our ransom to purchase us from the domination and penalty of sin. After He died on the cross He was buried. On the third day He rose from the dead according to the scriptures. This means that He literally came back to life in His physical human body. In raising Him from the dead God declared Jesus to be Lord of all, and the Messiah of Israel (the future world ruler from Israel promised in the Hebrew scriptures). After His resurrection, the Lord Jesus Christ appeared to His apostles and disciples, and was seen by them for 40 days. He then ascended to heaven to sit at the right of God the Father.

You may receive eternal life, forgiveness of all your sins, and rescue from everlasting punishment simply by believing this message in your heart.

This is the Good News I would like to proclaim to you and homosexuals, racists, etc. God will forgive you for this *sin* and all others because He paid for it at the Cross of Calvary. The sin of homosexuality and lifestyle is a choice, not an act of nature (God, if you like), because man does not want to take responsibility for his own actions. If you doubt what I say, just read what God says about this matter in the book of Romans 1:18-32. God does not hate homosexuals; neither do I. He hates the sin they commit and any sin we commit against Him. We are hopeless without the forgiveness and mercy that we can receive from the Lord Jesus Christ. God the Father gave us His perfect sinless Son to die for us, who are all sinners. We all deserve to burn in hell, but He gave us His Son for a means of escape.

A closing comment: You seem to equate homosexuality with racism; this is wrong. Yes, racism is sin the same as homosexuality. God only created one race and that is the human race for which He died. But you seem to want to put homosexuals in a minority status, of which they are NOT; this is wrong. It sounds as if you have been brainwashed by the liberal press and militant homosexual groups. Well, Wayne, I figure this letter will cause you to seethe in hatred for my Lord and Saviour even more, but the Scriptures say: "For the message of the cross is foolishness to those who are perishing, but to us who are being saved it is the power of God." (1 Corinth. 1:18) I will pray that the Lord grant you mercy and open your now-closed eyes to the TRUTH. (THE LORD JESUS CHRIST)!!!!!!!

Seethe in hatred? No, not at all. I enjoyed your letter. So you think that because I have a different set of beliefs that I have been brainwashed by militant homosexual groups? Au contraire mon ami—my brainwashing was for cleansing purposes, to wash away the barriers of ignorance, religious and political dogma—to enable me to have an open enough mind to read more than one book—to read what thousands of intelligent people have written—and to try to make sense of all this information epistemologically.

The liberal press is frustrated with me since I appear to them to be a staunch conservative. Militant homosexuals are frustrated with me because they don't want to believe that their behavior is genetically controlled. We all like to think we have free wills. Indeed, many people actually believe this.

Of course it was only about a hundred years ago that scientists called anyone crazy who believed that meteors were real. Plate tectonics is even newer, as are relativity, quantum and chaos theories. Yet each of these have changed our understanding of the world—and each is understandable, if one makes the effort. Little of value is available without effort, I hope you'll agree.

You didn't say which of the organized commercial religions you are selling, but you certainly are a truly inspired salesman. One thing puzzled me Bob—since the number seven is the mark of the devil, was your use of seven exclamation points at the end of your letter meant to tell me not to believe anything you wrote? That was the message you sent! . . . Cheers, Wayne

Don Smithana W9FFG, San Diego CA Being a "builder/experimenter" I feel highly about your magazine and the practical articles it contains. Aside from the construction articles, the advertising is one of the most interesting and beneficial parts of *73 Magazine*. Before considering any purchase, I always read the ads in your magazine. I believe you have to be somewhat older to realize the importance of advertising such as this.

There is an old saying, "Time is the best teacher, but leaves no students!" This was again evidenced in your fine editorial (Worrywart at Dayton) in the March 1992 issue. Actually it is more than a time to WORRY, it is a time to PANIC! Where are the skilled artisans of the electronic age, the deep resource of trained technicians who have more than computer buzzwords as a vocabulary? Your concern is well founded and I hope your voice of vision is not relegated to a faint whining in the dark wilderness. Our situation of technical jobs and skills has reached critical mass. Our "amateur radio fraternity" can help to focus on the national problems.

Having just returned from a business trip to the Tokyo area, I found all the more truth to your editorial. For those familiar, the "Electronic Experimenters section" of Tokyo is centered around Akihabara near the downtown area. In America, the whole area might be condemned as being an eyesore or firetrap. But, its tiny booths and display areas abound with the latest electronic devices as well as a wide variety of modern electronic parts and hardware. Not surplus military such as we used to find in cities like Dayton, New York, Chicago, etc. I am sure these areas in America helped spawn many new-wave electronic corporations. With the parts displayed today in Japan one can build prototypes of a most modern type. And I am sure new industries are built upon some of these experimental offerings.

What am I getting at? That we have lost much of the infrastructure of parts availability to actually engineer, to produce a quality product in the manner which helped found several of our major industries. It is the grass-roots effort of thousands of talented electronic aficionados that can build an industry—and the computer people in America know what many of these industries are.

Now Akihabara and Kanda areas of Tokyo were not always electronic centers. After the war I was one of the few television engineers to visit the area to buy parts, radio parts of a most primitive type. And long before that, it was an area of flat fields with red leaves on the trees, Aki ha bara (red leaf flat fields). What a major transformation! And it is one we must also accomplish if we are to effectively provide high-tech jobs for those who want them. No, we should not only WANT them, we NEED them. It may be that we need editorials such as yours to wake up the sleeping giant of apathy which resides in too many of us.

Jonathon Grimes KB4UHK, Kingsport TN I am a Tech-Plus licensee and have been licensed since I was 13, in 1988. Wayne, I would like to thank you and the staff for making a progressive, well-written magazine that is ready to go through all the risks of publishing in order to be exciting. (The same goes for *Radio Fun*—I subscribe.) I have been QRT for about three years until I got to read your magazine for the first time. What a change from *QST* and *CQ*! Your writers are encouraging and educating the readers from learning Morse to using spread spectrum, while the other magazines are still using three or more pages for Straight Key Night. Well fine, let 'em all live in the 19th century and leave the new scene alone. By being a mob of crotchety old geezers the old crowd has not succeeded in maintaining a country club atmosphere on our frequencies. Instead, they have alienated themselves from the new influx of hams and their peers who had a little more vision and a great deal more courage. So let's just sentence the spark gap crowd, the ARRL and *CQ* to 75m and the occasional pointless contest and be done with it, so your magazines can stop using up so much of their free space complaining through your editorials and letters like this.

Tom Rice WB6BYH, Livermore CA Wayne, in your June 1992 editorial you mentioned how the infamous Doyle Letters revealed that the ARRL president was paid by Hallicrafters to gain space in *OST*.

This tickles me, but for another reason. I have always wanted to know how it was that the Republic Studios had all that neat Hallicrafters stuff on display in their serials.

We're both old enough to remember the Saturday afternoon movies; for me, the serials were the big draw and probably responsible for making me the techno-nerd I am. I've now bought most of my old favorites on tape and, regressing a bit, still get a kick out of reliving those wonderful afternoons.

Anyway, I see all these neat old radios. In the earlier years, they were assorted brands: the Abbotts, the Bretings and so forth. But after 1940 or so, they're all Hallicrafters: S-20R, SX-24, SX-28, HT-9, etc.

So I have to ask: What did Bill Halligan have to do to turn every kid in town on to Hallicrafters radios for so many years? They were always the current models for the year the film was made, too.

Why were there never any other makes? (One exception was the National NC-240 seen in the spy movie "The House on 92nd Street," but that wasn't a Republic film.

This might make a joyful piece for *73*. I'm in full agreement with those who want more historical stuff, but not just League history; I really enjoyed your dad's early flying tales. Since we hams are mostly a bunch of old farts, a little nostalgia might just be in order. You'll never get us back to the bench and the soldering iron.

(I still have my old Sky Buddy from 1940. Should I build a QSL-40 to go with it? I've got the 6L6 and 40 meter xtals.)

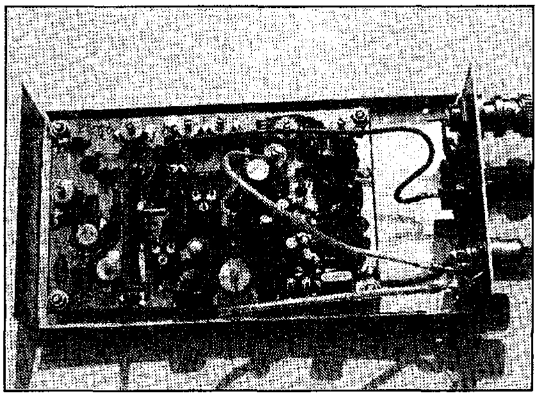
And do you remember all the B-movies from Producer's Releasing Corporation? PRCs were always el cheapo. I remember their using an S40 as a transceiver—switching the standby switch to pretend to transmit.

I'll bet there's someone out there who could do a great article on the old B's and the Hallicrafters radios in them . . . Wayne

73 Amateur Radio Today

August 1992
Issue #383

TABLE OF CONTENTS



Build an ATV transmitter . . . see page 22.

see page 22.

FEATURES

REVIEWS

Cover: Slow-scan or fast-scan . . . amateur TV is fun . . . and easy!
Cover photo by Bill Brown WB8ELK & David Cassidy N1GPH.

DEPARTMENTS

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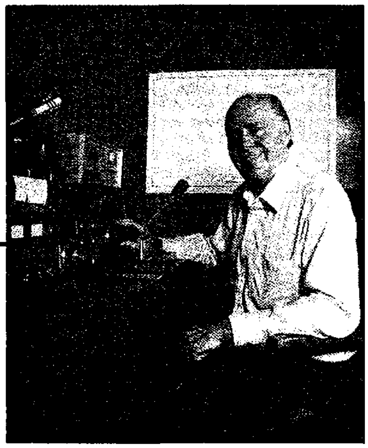
Audit Bureau of Circulations (ABC) membership applied for.

Contract: By reading this teeny-weeny type, you have just become legally obligated to the staff and management of *73 Amateur Radio Today* to introduce a friend to amateur radio. C'mon, how many times have you had people in your house, especially young people, and you never even bothered to show them your ham station? Next time, turn on the radio and show them how much fun it is. Let them make a QSO or two (that will hook 'em). While you're at it, make sure you tell 'em about *73*. Better still, how about forking over a measley $12.95 and giving them a gift subscription to *Radio Fun*?

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Inner City Hams

One thing you can bet on, none of those rioters you saw burning and looting the inner city businesses were hams. The rioters were, for the most part, gangs on a rampage. So how come we have such persistent poverty? Why are our cities infested with increasingly large gangs? Well, before we can do anything about all this we have to understand what's gone wrong. If you don't know what's broken, you sure aren't likely to fix it. Alas, I see no hint that our politicians have a clue as to what's gone wrong.

Yes, there are lots of symptoms—any illness has symptoms. And until fairly recently all doctors could really do was treat symptoms and wait for the patient to cure or kill himself. So we are dwelling on the symptoms of poverty, while ignoring the cause. We're trying to cope with lousy, overpriced housing, welfare, drugs, crime, school dropouts, pimps, the homeless, street gangs, organized crime, pornography, and so on.

For the last few months I've been doing a bunch of research on our educational system. Oh, we know it's failed us in comparison with the educational systems of all other developed countries. We've seen one report after another citing our American educational shortcomings. As a member of the New Hampshire Economic Development Commission Educational Subcommittee and the New Hampshire High Tech Council's Educational Subcommittee, I've been listening to and talking with a wide range of educators. Further, I've also been doing my homework, reading the latest books on what's gone wrong with our system, plus some very good ideas on what to do about it.

The more I've read and heard, the more convinced I am that the root cause of poverty in America is the direct result of our crummy educational system. It isn't the blacks. It isn't the Hispanics. It isn't drugs. It isn't laziness. It isn't even our incredibly awful welfare system. It's our totally out-of-date educational system which has generated this incredible and expensive, embarrassing mess. It's also got a lot to do with so few kids being interested in technical hobbies such as amateur radio—so we have a vested interest in educational reform.

Actually, reform is too modest a term for what's needed. We have to completely reinvent education, not just make some changes. Alas, we also need to reinvent our political system too. I think we can almost agree that it's failed us. It was this failure which opened the door for even worse political systems such as fascism, socialism and communism. Most of us are gradually becoming aware of how bad the mess in Washington is—and we have no reason to hope that it's much better with our state governments.

Well, let's look at what we can do to clean up the educational mess first and then, if we have any survivors, we can tackle our governmental messes. If we can turn around education in America, we'll be the strongest country in the world in technology, electronics, money and power. If we don't, we're heading down the road of poor old Britain—previously known as Great Britain. Their educational system, while slightly different from ours, also sucks.

The world, and our schools, moved from the agricultural age to the industrial age. Now it's in the information age. Our schools managed the change from agriculture to industry, going from about 75 days a year to 180. The problem is that they haven't been able to come to grips with the information age. And this is going to take a lot more than adding a few courses to the curriculum. It's also going to have to fit in with the changes in family life which television, divorce and working parents have brought about. The family life of 50 years ago is almost completely gone. Children aren't being educated during their first few years at home by their mothers any longer, they're parked in day-care centers, hypnotized by "Sesame Street."

When you consider that it's during the first few years that children's brains develop and that without good stimulation the neuron circuits don't develop well—a growth process that once missed can't be repaired later—you start getting a hint as to why so many of today's children can't read, can't even speak very well, have short attention spans, and are unmotivated. And of course, all this is made even worse in the ghettos, where there are so many fatherless homes and 80% of the children are illegitimate.

Adding to that incredibly bad start, which permanently brain-damages children, we then subject them to a government-run educational system which is largely irrelevant to their lives. We don't teach them about how to work with others, how to select a mate, or the things they will need to know to work as carpenters, plumbers, electricians, salespersons, telemarketers, and so on.

During year two, when they are learning to talk, are we teaching them American English, or ghetto argot? Yes, English is "whitey talk," but it's also a key to making success possible in this country. By the time they're starting in kindergarten their speech patterns are so permanently built into their brains that it takes an enormous amount of work to overcome them. Just as it's easy to teach young children to speak many languages, all without any accent, if we bypass the growth period when their minds are building the needed neuron circuits for speech, they'll never have them. We can teach them a foreign language when they are in high school, but it's ten thousand times more difficult and they'll never be able to speak without an accent. Well, the same goes for the black argot and Hispanic Spanish.

The black community also is screwing up their kids by emphasizing the wrong role models. Blacks tend to look up to athletes, the clergy, entertainers, drug dealers and pimps. This certainly doesn't encourage kids to think in terms of working or being an entrepreneur. This is one reason why the Koreans have been able to be so successful setting up their stores in black neighborhoods.

By first depriving blacks of the ability to speak American English, and an interest in learning or working, and then dumping them into schools which try to get them to memorize facts about history, geography, literature, and math—things they'll never need, we're dooming them to poverty. They must, by law, go to the public school they're assigned. Doesn't this whole program qualify as cruel and unusual punishment? Is it any wonder we have so few black hams managing to survive this educational holocaust?

The more I read about our educational system, the more inclined I am to agree with the few brave educators who are crying for radical changes. They claim that with a better start during the first through fifth years, kids could learn to read and write in a year or two and be able (and motivated) to pursue their own educations from then on. Understandably, many teachers and teacher unions are ready to fight to the death to preserve the present system.

Kids work better in teams, with coaches instead of teachers. It's called cooperative education and it's worked miracles where it's been tried. But the most important change needed is in day care, where kids need to be exposed to the stimuli their brains need to help them develop during their early years. A public investment in better preschool education will repay its cost a thousand times over in lower crime rates, a gradual reduction in single parent families, a better educated work force, and a higher standard of living for everyone. We have no need for poverty. It benefits no one. It is possible for everyone to make more money.

With better preschool education, and with a school system which is relevant to life for kids—a non-compulsory system—we can turn this inner city mess around. It's time to stop blaming the street gangs for crime, drugs, burning and looting, and fix the situation which has resulted in this disaster.

A Street Gang Solution

So what can we do with the mess we have right now, with tens of thousands of uneducated blacks and Hispanics in street gangs? It's too late to read and speak English, so are they a completely lost cause? They need to be encouraged to learn skills so they can work in trades. If we had prisons which really reformed people instead of merely making them better educated criminals, prison might be a good solution. That would help break the lousy role model patterns being handed down from generation to generation.

But prison not only doesn't reform, it also costs like crazy. Prison costs are higher than health costs and are rising even faster. But suppose we could both turn prisons into educational centers to teach skills and lower their costs by 90-110%? Think that might work? With prisons costing around $25,000 a year per prisoner, it's no wonder so many petty criminals are being released by our hopelessly overcrowded system. And that hardened criminals are being paroled early.

If we can both reduce prison costs and turn them into re-education centers, we'll be on our way toward solving a good deal of our crime and inner city gang problems. But how can we go about teaching skills and changing

Continued on page 78

QRX . . .

Voice of America Club Gets K3VOA Callsign

The FCC assignment of a specific callsign to an amateur radio club made up of employees of another government agency is raising a lot of eyebrows in ham circles.

In an unprecedented move, the FCC has issued a license modification to the Voice of America Amateur Radio Club to change its amateur radio callsign from K3EKA to the more recognizable callsign K3VOA.

For more than 10 years the club has made several informal inquiries in an effort to secure a "VOA-suffix" callsign. In every case the FCC cited the request was specifically prohibited by the regulations. Rule 97.17(f) states: "A callsign will be systematically assigned to each station. FCC will issue public announcements detailing the policies and procedures of the callsign assignment system. The FCC will not grant any request for a specific callsign."

During VOA's 50th anniversary in February, the new USIA Director of the Bureau of Broadcasting (which includes VOA), Chase Untermeyer, expressed a desire to visit the VOA ARC ham shack. Club president, Al Brown WA3FYZ, felt that this would be a perfect opportunity to ask Mr. Untermeyer to intervene on the club's behalf and ask the FCC chairman to grant an exception. Mr. Untermeyer agreed and asked Al Brown to draft a letter for him to sign, which was sent to Alfred Sikes, chairman of the FCC, in March.

In his reply, Mr. Sikes states that considering the importance of the 50th anniversary of the Voice of America and that other governments around the world have issued VOA-suffix callsigns, "I have asked . . that Rule 97.17(f) be waived and that the VOA headquarters amateur radio station be issued a 'VOA-suffix' callsign."

The license of the new callsign K3VOA was mailed from the FCC office in Gettysburg, Pennsylvania, on May 7th.

To our knowledge, this is the first time since the adoption of FCC Rule 97.17(f) that a waiver has been granted. The rule really dates back to the early 1970s when it was fairly common for the FCC leadership to reward distinguished amateurs and notable organizations with preferential call letters at no cost. *TNX W5YI Report, Volume 14, Issue #11, June 1, 1992.*

Has UPS Given Up on 220?!

It appears as if United Parcel Service has changed its mind about developing an all-AC-SSB voice and data network in the newly reallocated 220-222 MHz band. On May 14, the *Tulsa World* (Oklahoma) newspaper reported that UPS had entered into an agreement with GTE, McCall, Pac-Tel and Southwestern Bell to use cellular telephone frequencies for data communications between its five thousand trucks and their offices.

A United Parcel spokesman was quoted as saying: "We have the fleet. We have worldwide computer communications. And now, we link it all together as the first cellular data network."

Amateur radio operators in the Tulsa area and elsewhere are now wondering if this means that United Parcel Service has abandoned its well-publicized plans to use the lower two megahertz of the former 220-225 MHz amateur band for their corporate wide communications network. *TNX Mike Reynolds WØKIE and Westlink Report, Number 627, June 15, 1992.*

VECs Hold Annual Conference on Ham Testing

Volunteer Examiner Coordinators representing more than 98% of all amateur radio operator license examinations conducted in the amateur service met on June 11 and 12 in Gettysburg, Pennsylvania, at their annual conference. Several FCC officials and 12 out of 18 VECs were present at the meeting.

In his opening remarks, Personal Radio Branch Chief John B. Johnston congratulated the VEC System for efficiently coordinating 41,000 exam sessions, examining 477,000 applicants and administering 777,000 test elements in its nine years of operation since 1984. "That is a record for which you should be very proud."

Johnston, and later Private Radio Bureau Chief Ralph Haller, both licensed amateurs, covered many items of general interest to the ham community. Johnston pointed out that the Technician class has become the entry level of choice. He also told attendees that: "In spite of the additional work you've been doing, you have been able to actually improve on quality. The defective applications (0.4%) were the best ever. You are doing a good job. And this is very important because an error on an application hurts everyone. There are labor costs to correct that error. Labor that should be spent on providing a faster speed-of-service must be diverted to obtaining the correct information for that defective application. It delays the processing of all licenses . . . and it delays the newcomer from getting on the air."

Johnston also noted that: "Your system is far superior to the previous [FCC] system. There are many more locations where examinations are administered. . . . Your system is superior in terms of the days of the week exams are administered. Exams can be taken on the weekends and in the evenings. Your VEs solved the problem of limited opportunity.

"There is a big improvement in the questions. We were never able to keep the written exams current with the rules or with your state-of-the-art. We never were able to provide enough different code tests. Our exams were always compromised the very first time they were used."

Johnston also discussed the Technician Plus data base, rulemaking and the question pools, voluntary and involuntary retesting, and handicapped code credit.

Ralph Haller said that the FCC is looking into a program of "auto grant" 24-hour licensing turnaround through electronic filing. The goal is paperless communications with Gettysburg. The requirement that the FCC actually see a written signature on the Form 610 application will be eliminated under a new amendment to FCC Authorization legislation now in process. Actual signatures would be kept with the VEC."

Haller also said there would be a proceeding issued shortly that would relax the "no business" communications rule. *TNX W5YI Report, Volume 14, #12, June 15. 1992.*

Revised Form 610 Amateur Application Issued

The FCC's Forms Distribution Center has received a large shipment of revised "Application for Amateur Radio Station/Operator License," Form 610. It carries an issue date of March 1992 although it has just recently been received at the forms warehouse.

The form is now being printed on goldenrod rather than buff colored paper. It is the first revision in more than two years and carries an expiration date of February 28, 1995. It is six pages long due to four pages of instructions. Here are some of the changes:

(1.) The new form now includes the *Physician's Certification of Disability* and *Patient's Release* needed for handicapped 13/20 wpm telegraphy exemption. It is no longer necessary to submit another form with the application to obtain a handicapped telegraphy exemption. VEs are instructed to write in the letter "H" in the Administering VEs Report in Item C under Element 1C.

(2.) Applicants are now required to initial all requests for a callsign change. (Section I, Line 2E.)

(3.) Section I, Line 6 (Date of Birth) now has hyphens (rather than slant bars) to eliminate the possibility that the slant bar might be mistaken for the figure "1." Instructions now require that two figures be placed in each of the month, day and year spaces. For May 1, 1947, write in 05-01-47 (not 5-1-47).

These forms are available from the FCC's Forms Distribution Center by leaving a message on the phone (202/632-FORM). *TNX W5YI Report, Volume 14, Issue #11, June 1, 1992.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924—0058, or by mail at *73 Magazine,* Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924—9343 (300—2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun.* You can also send news items by FAX at (603) 924—9327.

Number 4 on your Feedback card

The ViewPort VGA Color SSTV System

At last—a versatile slow-scan TV program and interface for the IBM PC.

by J. R. Montalbano KA2PYJ

A ROBOT compatible color SSTV system for the IBM PC has been long awaited. The lack of affordable display controller boards capable of displaying more than 16 colors has made such a system unfeasible. This situation is changing as the cost of display controllers capable of displaying more than 32 thousand colors is dropping below $160. At the 1992 Dayton HamVention, I demonstrated an IBM compatible SSTV system which can send and receive air-worthy SSTV pictures using an inexpensive hardware interface and a computer equipped with one of these standard displays. To date, over 100 hams are enjoying SSTV using a system I call ViewPort VGA. This article describes the hardware and software of that system.

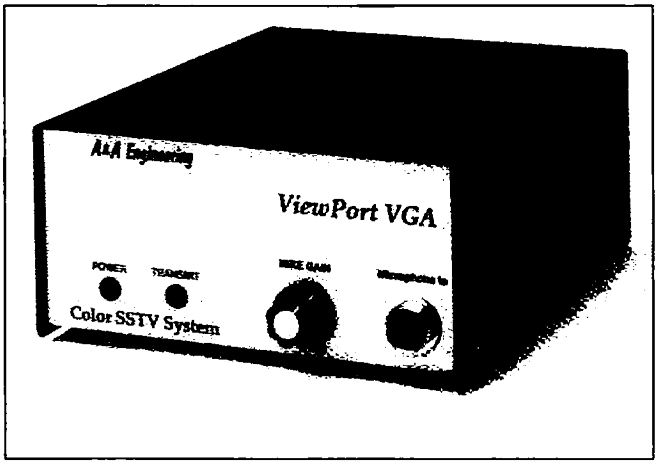


Photo A. The ViewPort VGA interface allows you to receive and transmit color SSTV with an IBM PC or compatible.

Hardware Requirements

The hardware interface is a modified version of John Langner's (WB2OSZ) interface to the Atari ST (*73 Magazine*, December 1989 and January 1990). That board was designed to connect to a high-speed serial port on the Atari computer. The PC does not have a fast enough serial interface, so I modified the board to connect to the PC's printer port. Figure 1 shows the station configuration for the system.

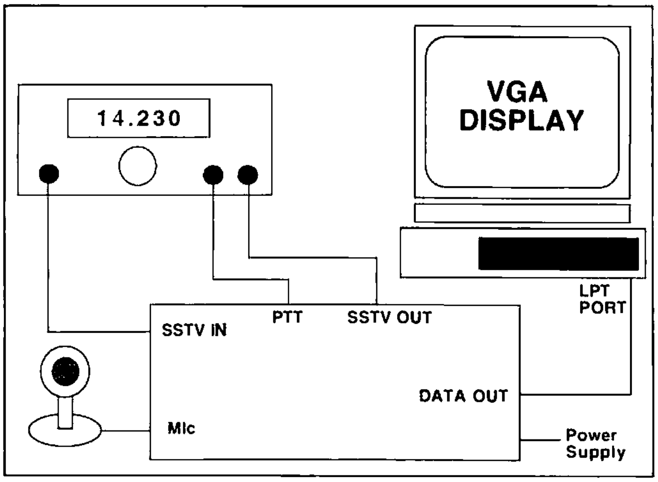


Figure 1. ViewPort VGA station configuration.

The software has been tested on systems ranging from a 4.77 MHz XT to a 33 MHz 386. The hardware interfaces to LPT1 at address $378 or LPT2 and address $278. You will need at least 640K of memory. This system requires a VGA board that can display 256 colors at 320 x 200 resolution. The software also supports the latest HiColor™ VGA display adapters. These are capable of displaying 32,768 colors on your VGA screen. The results are excellent.

Compatibility With Existing SSTV Modes

Many new slow-scan television formats have been introduced since the early days of eight-second B/W transmission. Each has its own advantage in terms of resolution, transmission time and noise immunity. The mode names usually identify their inventors, followed by a reference to the transmission speed in seconds (e.g. ROBOT 72 or AVT 94). A computer-based system such as this offers the potential for compatibility with all of the modes since the format decoding is done in software. At the time of this writing, the software supports the most popular ROBOT modes (see Table 1). You will be able to receive about 80% of the pictures transmitted on the popular SSTV operating frequencies. A version to support the European B/W and Wraase modes is being tested and will be available soon. Other modes may be added in the future.

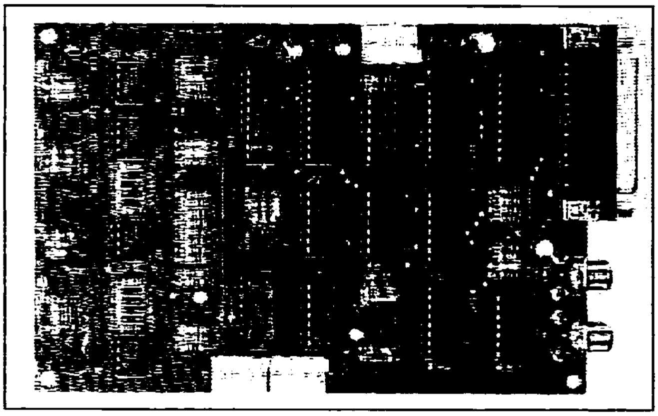


Photo B. The SSTV interface board.

Slow-Scan Demodulator

The demodulator is similar to the one presented in "Color Computer SSTV," by K6AEP and WB8DQT, in the November and December 1984 issues of *73 Magazine*. The demodulator converts the FM-modulated slow-scan audio signal into an amplitude-modulated video signal. This AM video signal is converted to digital format by an A/D converter where it can be read by the PC through a printer port. The computer interprets the digital signals from the A/D to produce the correct display on the computer monitor.

The slow-scan audio signal is first amplitude-limited by U1b. The square wave output of U1b drives two band-pass filters built around U1a and U2b. One of these (U2b) has a center frequency of about 1200 Hz and the other (U1a) has a center frequency of about 2300 Hz. When the outputs from these filters are rectified and summed out of phase by U2A, the result is an amplitude-modulated audio signal. The band-pass filters built around U3a, U3b and U4b pass only the video components below 950 Hz. RO and RV set the offset and gain of U4 to produce a zero volt DC at TP-3 with 1200 Hz input frequency and 5 volts DC with a 2300 Hz input signal.

Figure 2 shows the waveform present at TP-3 when a five-step gray-scale signal is input to the demodulator. The clock input of the A/D (U12) is strobed at a rate controlled by the software. Each time U12 is strobed, an 8-bit word is output at D0-D7, which represents the amplitude of the waveform at TP-3 at that instant. U12 outputs Hexidecimal $00 for 1200 Hz (sync),

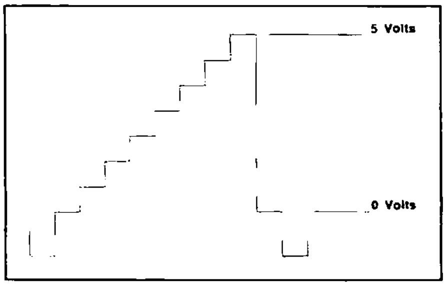


Figure 2. Waveform at TP-3 with gray-scale input.

$46 for 1500 Hz (black) and SFF for 2300 Hz (white). Video levels between black and white are represented by 8-bit values between $46 and $FF. U11 multiplexes the 8-bit output of the A/D into two 4-bit nibbles so that this data can be input to the four status input bits available on any standard Centronics printer interface.

Slow-Scan Modulator

The modulator is a modern digital design that never requires adjustment. The time base for the circuit is a 4 MHz crystal (X1). U5 and U6 are a divide-by-n counter which is programmable by the PC through bits PD0-PD7 on the printer interface. U7, U8 and R42-R44 produce a sine wave output whose frequency is 250,000/(256-n), where "n" is the 8-bit value presented on PD0-PD7 by the computer.

When both PD6 and PD7 are high, K1 opens and the interface is in the receive mode. When either RD6 or RD7 are low, relay K1 energizes to key the rig and to connect the modulator output to the rig's audio input.

The circuit built around U13 prevents the interface from entering the transmit mode when the PC initializes the printer port during power up. The QD output is cleared at power up, or when the interface is in the receive mode. The software strobes U13-4 eight times to enable the transmit mode.

Construction

Several point-to-point and wire-wrapped prototypes have been built successfully. Alternately, a PC board and/or a complete kit of parts is available from A & A Engineering (2521 W. LaPalma, Unit K, Anaheim CA 92801; (714) 952-2114, see the Parts List for details). A 25-pin D-SUB connector is used for the interface-to-printer port connection. A microphone connector is used to connect audio and PTT to your rig. In addition a +/-12-volt 100 mA and a 5-volt 300 mA power supply are required.

Alignment

Connect the interface to your computer's printer port. You must change the LPT: parameter in SSTV.CFG to LPT:2 if you connect the interface to LPT2. Connect the modulator's tape output to the demodulator input with a jumper wire. Select the Loopback function from the SETUP menu (see Photo G). This causes the modulator to produce a sequence of 1200 Hz, 1500 Hz, 1900 Hz and 2300 Hz tones. The program reads the resulting values from the A/D converter and displays them graphically. Adjust RO and RV until the indicators line up with the corresponding arrow heads. The indicators for the sync and white levels should just reach the0 and 255 arrows. If you go beyond those points, you may not be able to set the 1500 and 1900 Hz levels correctly. Press the space bar to momentarily pause the program. The values displayed on the right side of the screen should be within +/- 4 of 0 70, 164 and 255.

{NOTE: Those of you fortunate enough to have 486 machines will need to switch them out of the turbo mode when running the loopback program.}

Operation

The user interface is quite simple since it was designed for single keystroke operations. There are four menus in the current software (Photos D–G). Switch between the RECEIVE and TRANSMIT menus by pressing "r"

Photo C. An actual received image using the ViewPort VGA SSTV system.

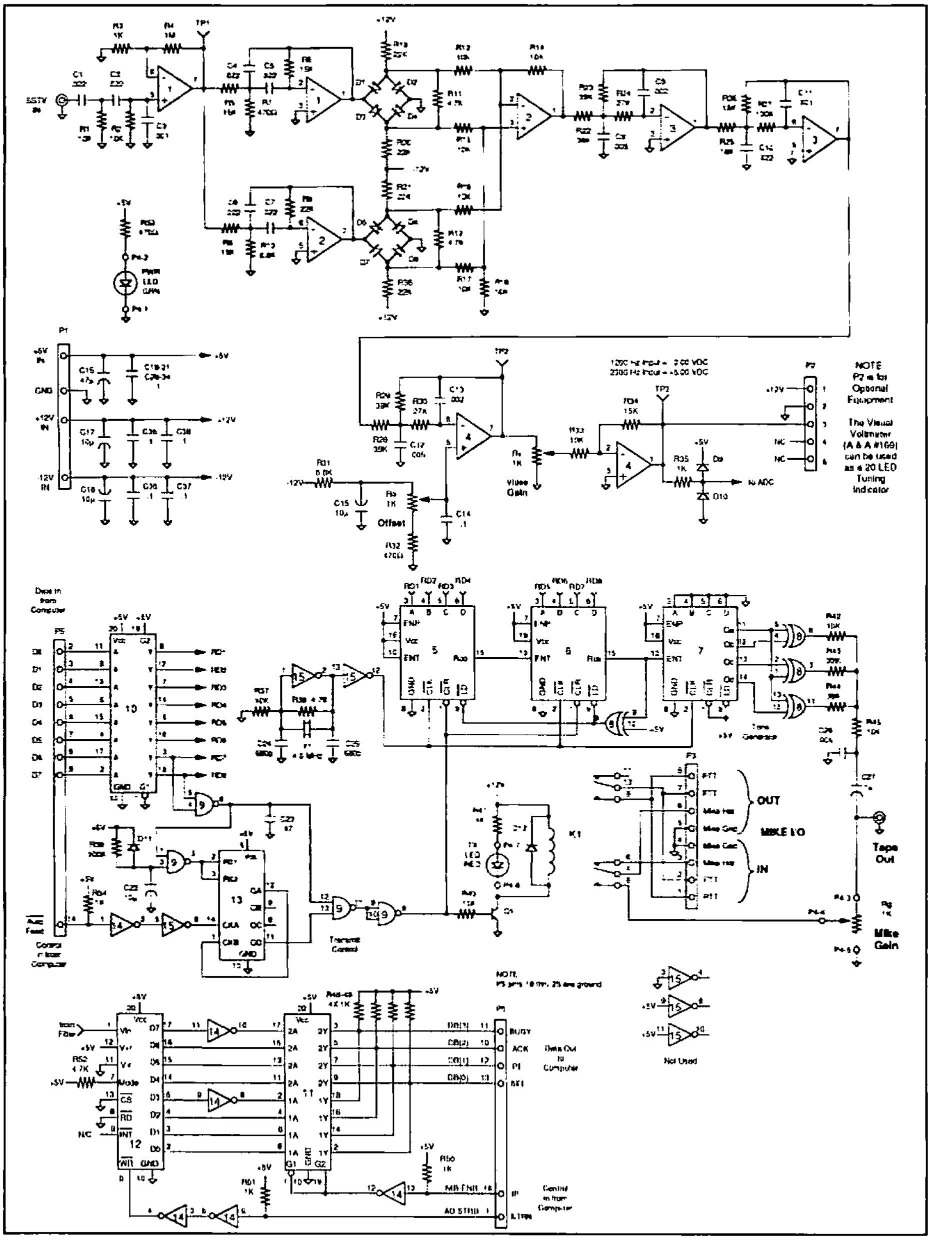


Figure 3. (a). Schematic diagram of the SSTV demodulator section. (b) Schematic of the SSTV modulator section.

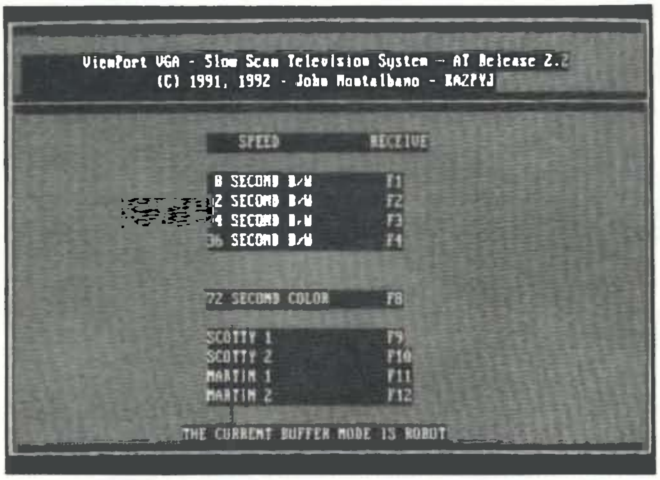


Photo D. The Main menu of the SSTV program.

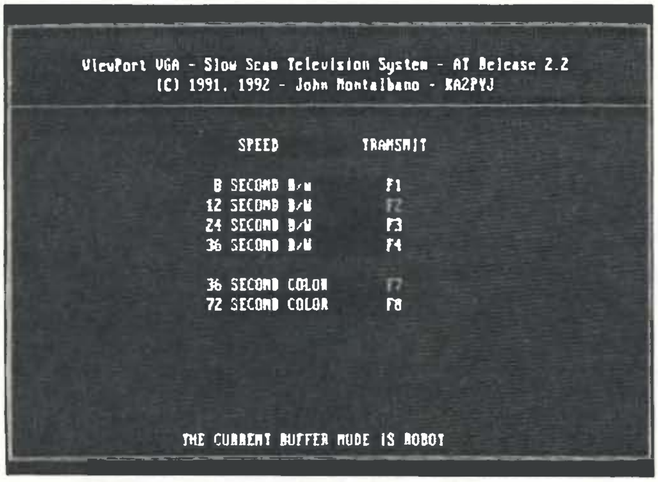


Photo E. The Transmit menu of the SSTV program.

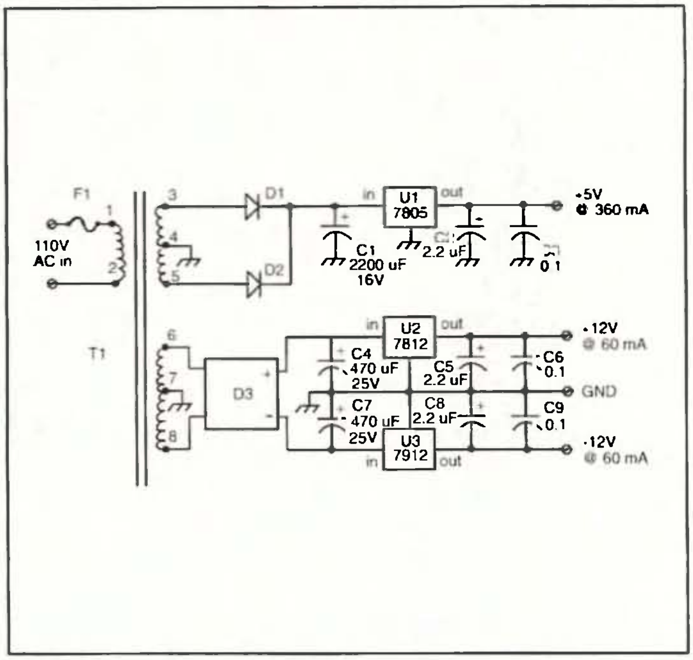


Figure 4. Power supply schematic diagram.

or "t." Press "escape" to bring up the ADDITIONAL FUNCTIONS menu from which you can load and save pictures to disk. The SETUP menu can be accessed from the ADDITIONAL FUNCTIONS menu. Pressing "q" at any menu terminates the program.

Receive Mode

Modern SSTV transmission formats include a digital header called a Vertical Interval Signal (VIS) to indicate to the receiver the mode being sent. The current software does not support the VIS in the receive mode. Courteous SSTV operators will also identify the mode by voice before transmission. Listen for the sending station to send two short tones which signal the start of a picture. Press the appropriate function key to begin reception. Press any key during reception to abort.

The program uses the VGA's 320 pixels by 200 lines display mode. Modes that use 128 pixels by 120 lines are displayed in full. Modes with more than 200 lines will be received in full, but only the first 200 lines will be displayed. When the transmission is complete, press any key to return to the main menu (see Photo D). The received picture disappears from the screen, but is saved in memory. Press ENTER to re-display the picture. This time, the software "tosses out" every sixth scan line so that the entire picture fits on the 200 line display.

While receiving, the program displays the picture with a default palette of colors selected from 256 thousand possible choices. Although this produces reasonably good pictures, you have the option to do some image processing to improve them. Press ESC to enter the Additional Functions Menu (see Photo F). Save the picture to disk. You will be prompted for a file name. After the file is written, selecting CUSTOM COLOR PALETTE LOAD invokes an image processing function which analyzes the picture to make a better selection of 256 colors with which to represent the picture. Enter the file name of the picture previously saved to disk. The routine takes about 30 seconds on a 20 MHz 386, so be patient. When the routine finishes, it will display the improved picture. There is no need to save this version of the picture since it is already saved with 32K color resolution.

You should be aware that since the VGA can display only 256 colors, a small error in frequency can result in a large error in color. The received picture will usually be too pink or too green if you are off frequency. A scope connected to TP3 makes a convenient tuning indicator. While receiving a slow-scan signal, tune the rig so that the tips of the sync pulses are at zero volts. With practice, you will learn to tune in pictures without using the scope. Some stations now have the capability to send a constant 1200 Hz tone. While in the RECEIVE menu, pressing "+" will produce 5 seconds of 1200 Hz audio from your PC's speaker. Use this tone to zero beat the received tone.

While in the TRANSMIT menu (see Photo F), pressing "+" will send 5 seconds of 1200 Hz against which other stations can zero beat their locally generated 1200 Hz tone.

You should also be aware that the ROBOT modes are susceptible to noise. In particular, when noise occurs during a sync pulse, the software might skip an entire scan line of the video. Noise which occurs during a scan line gets translated into video and typically appears as "snow." I have received "closed circuit" pictures with S-7 to S-9 signals and a noise level of about S-3. Keep in mind that the overall signal to noise ratio is more important than the signal strength.

Transmit Mode

Most SSTV operators using commercial equipment have a video capture device with which to digitize their own pictures. There are many such devices available for the IBM PC ranging in price from $89 to $3,000. The least expensive boards can digitize monochrome video only. Each frame takes several seconds to digitize, so the subject must remain very still. This type of board is referred to by slow-scanners as a "digitizer." Creative SSTV operators have learned to use digitizers to produce color pictures by using color filters in front of the camera lens and then mixing red, green and blue frames to make a composite color picture.

The more expensive devices ($350 and up) accept an NTSC video signal from your color camera or VCR and digitize a frame in 1/30 of a second. These are referred to as Real Time Frame Grabbers. These are more appropriate for digitizing live subjects such as yourself proudly posed in front of your hard-earned ham equipment. Some examples of digitizers are: Colorburst, Ventek and Digital Vision Computereyes. [*Ed. Note: See this month's ATV column for a discussion of video digitizers.*]

Either type of device will usually come with software which controls the digitization and storage to disk of pictures. These usually store the digital picture in a common image file format such as GIF, PCX or TGA. ViewPort VGA

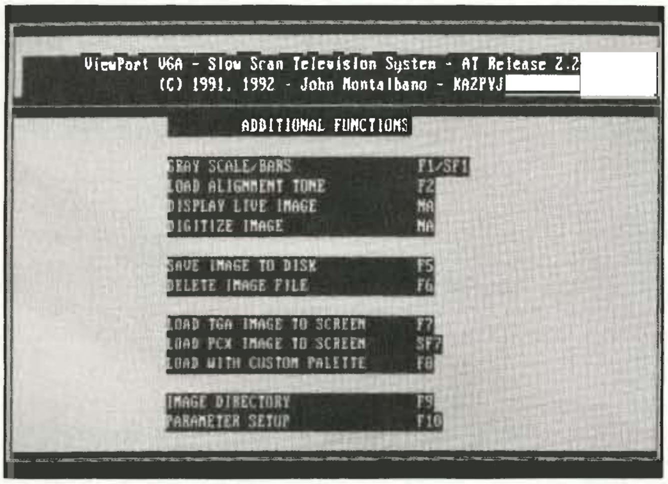


Photo F. The Additional Functions menu.

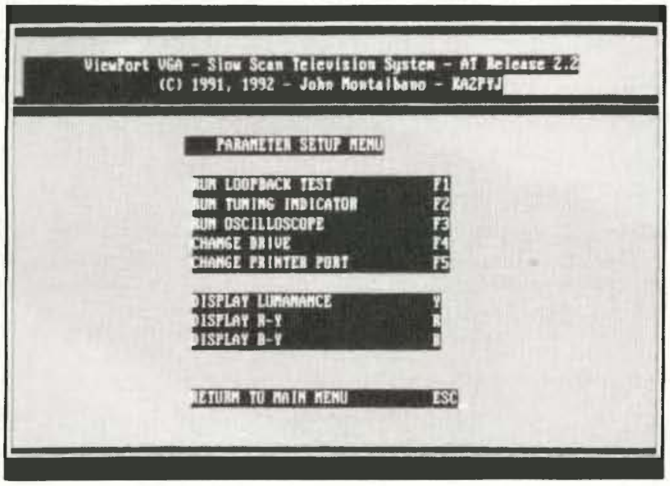


Photo G. The Parameter Setup menu.

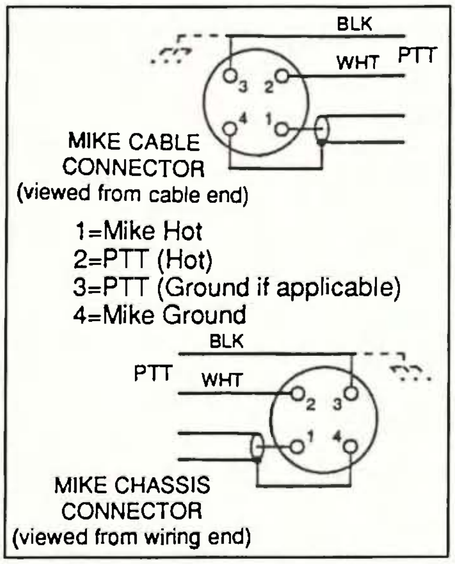


Figure 5. Microphone jack wiring to the SSTV interface.

version 2.4 software supports the 256 color PCX and 32K color TGA file formats.

If you do not own a video camera or frame grabber, you can find thousands of pictures stored in the GIF™ file format on computer bulletin boards and sold on floppy disks at hamfests. Use only the ones made for 256 color VGA displays. These are usually high quality pictures and offer a wide variety of subject matter. Use a program such as VPIC to convert the GIF format to PCX format. This will usually produce files with resolutions beyond the 256 x 240 SSTV format. Use a program such as Zsoft's PC Paintbrush (256 color version) or Alchemy Mindworks Graphic WorkShop to scale 640 x 480 images to 256 x 240 pixels or 320 x 200 images to 256 x 200 and save them as a PCX files.

Press ESC to bring up the Additional Functions Menu. Load a picture file. Enter the file name at the prompt. The picture will be loaded in full 32K color resolution and displayed on the screen in 256 colors. Press any key to return to the main menu. Announce to the receiving station (and to the dozens of others who are "just listening in") what transmission mode you will be using. Now select that mode by pressing the appropriate function key. The software will send the VIS code for that mode, followed by the picture. The menu will indicate what mode you are transmitting in. Press any key during the transmission to abort.

Improve Your Image With ViewPort 32K

Many hams are enjoying ViewPort VGA on their standard 256 color VGA adapters. Others have upgraded to the HiColor VGA boards which display received pictures with full-color resolution. ViewPort 32K supports HiColor VGA boards manufactured by Swan Technologies, United Solutions and Diamond SpeedStar. I recommend the Diamond SpeedSTAR HiColor board since it is shipped with a copy of WinRIX, a very powerful picture editing and titling program which runs under Microsoft Windows. ViewPort 32K software is enabled by setting the HICOLOR parameter in the file called SSTV.CFG to HICOLOR:1.

Pictures are displayed with 256 colors as they are received. Pressing the enter key at the end of the transmission causes the picture to be repainted instantly using 32,768 colors.

Comments

ViewPort VGA is the result of hundreds of hours of experimentation, programming and on-air testing on my part. I owe many thanks to John Langner WB2OSZ who inspired me to take on this project and who openly shared his experience with the Atari version of the system. Special thanks to Johann N5CST whose 20 over 9 signal was my SSTV test generator into the

Parts List

R1,R2,R13,R14,R15, R16,R17,R18,R33, R37,R42,R40,R45	10k resistor
R3,R35,R41,R46,R47, R48,R49,R50,R51,R54	1k resistor
R4	1 MEG resistor
R5,R6,R8,R34	15k resistor
R7,R32,R53	470 ohm resistor
R9,R19,R20,R21,R36,R43	22k resistor
R10,R31	6.8k resistor
R11,R12,R38,R52	4.7k resistor
R22,R23,R28,R29,R44	39k resistor
R24,R30	27k resistor
R25,R26	18k resistor
R27,R39	100k resistor
Rg	1k panel mount potetiometer
Rv, Ro	1k/15 turn vertical mount PCB potentiometer
C1,C2,C4,C5,C6,C7,C10	0.022 uF mylar capacitor
C3	0.001 uF ceramic disc capacitor
C8,C12,C26	0.005 μF mylar capacitor
C9,C13	0.002 μF mylar capacitor
C11	0.001 μF mylar capacitor
C14,C19,C20,C21,C28-C38	0.1 μF mono capacitor
C15,C17,C18,C22	10 μF radial electrolytic capacitor
C16	47 μF radial electrolytic capacitor
C23	0.47 μF mono capacitor (474)
C24,C25	680 pF disc capacitor
C27	1 μF radial capacitor
D1-D12	1N4148 diode
Q1	MPSA13 transistor
Y1	4.000 MHz crystal
U1,U2,U3,U4	LM1458 IC
U5,U6,U7	74LS161 IC
U8	74LS86
U9	74LS00
U10,U11	74LS241
U12	ADC0820
U13	74LS93
U14	74LS14
U15	74LS04
K1	12 VDC relay
P1	4-pin 0.156" header
P2	5-pin 0.100" header
P3	8-pin 0.156" header
P4	7-pin 0.100" header
P5	25-pin PCB female D (computer I/O)

Optional Power Supply

C1	2200 μF/16V radial electrolytic
C4,C7	470 μF/35 V radial electrolytic
C2,C5,C8	2.2 μF radial
C3,C6,C9	0.1 μF disc ceramic
D1,D2	1N4004 diode
D3	200V @ 1A, WO2M (or WB152) diode bridge
U1	7805T
U2	7812T
U3	7912T
T1	28 VCT @ 140 mA & 9V @ 0.5A, MPC-X-12 power transformer (or A&A 110-X-12)
Misc	heatsink, PC board

NOTE: The following are available from A & A Engineering, 2521 W. LaPalma, Unit K, Anaheim CA 92801. Phone: (714) 952-2114, FAX: (714) 952-3280.

Complete kit which includes power supply, main SSTV interface board and a prepunched, painted and lettered aluminum enclosure
#189-ENC $169.95

Completely assembled and tested SSTV interface unit in its case
#189-ASY $229.95

Board level kit without the case or mounting hardware
#189-KIT $129.95

Blank SSTV PC board
#189-PCB $19.95

Blank power supply PC board
#133-PCB $7.95

6-foot, 25-pin male to male cable
#6-25-MM $10.00

Shipping/insurance is $5 additional per order. California residents please add 7.75% sales tax.

Using the ROBOT 400 for Color Receive

Owners of the once popular ROBOT 400 B/W scan converter will be happy to know that they can upgrade the ROBOT 400 to receive color pictures on a PC with VGA display for about $20. Figure 6 is a schematic of that interface. The audio input to this circuit is connected across the Receive Contrast control on the 400. The ROBOT 400 provides all the necessary power supplies.

To modify the ROBOT, remove the cover and unplug the main circuit board. You'll find plenty of room in the bottom of the ROBOT unit to mount the interface circuit shown in Figure 6. There is a terminal strip inside of the 400 where you can tap into 5 volts and +/- 12 volts for the interface circuit. When you mount the circuit in place, make sure you have the RO and RV pots positioned so that you can reach them with a tuning tool through small holes in the ROBOT. Tap the interface circuit onto the "hot" lead of the Receive Contrast control on the 400 as shown and run a ribbon cable out of the ROBOT between the chassis and the case over to your computer's parallel port. If you want a fancier installation, you may want to mount a DB-25 connector on the back of the ROBOT. Then just reinstall the ROBOT main PC board and power it up.

To adjust the ROBOT interface circuit, send a 1200 Hz tone into the audio input and adjust potentiometer RO for 0 volts as measured at test point TP3. Then send a 2300 Hz tone and adjust potentiometer RV for a reading of 5 volts at TP3. Since there is some interaction between the two adjustments, you will have to repeat these two steps until you achieve the final results. Now just run the ViewPort software and you have an inexpensive, but powerful, color SSTV receive system.

SSTV Nets

IVCA	Sat. 1500 UTC, 14.230 MHz
North American	Sat. 1800 UTC, 14.230 MHz
South American	Wed. 2300 UTC, 14.236 MHz
European	Sat. 1300 UTC, 14.233 MHz
South Pacific	Sun. 0400 UTC, 14.247 MHz

Parts Availability

ViewPort VGA Release 2.4 is shipped by A & A Engineering with the purchase of a bare board or kit. ViewPort VGA software is not copy protected so that it can be made easily available to you through bulletin boards and other hams. KA2PYJ requests a registration fee of $12 from users of the software. The ViewPort software is also available from the *73* BBS at (603) 924-9343. If you don't have access to a modem, you can send $12 directly to the author for a copy of the latest version, please indicate your disk format.

For the latest version of VPIC, send $20 to: Bob Montgomery, 543 Via Fontana #203, Altamonte Springs FL 32714-3172.

For the latest version of Graphic Workshop, send $40 to: Alchemy Mindworks, Inc., P.O. Box 500, Beeton Ontario L0G 1A0, Canada.

HiColor is a trademark of Sierra Semiconductors.

Diamond Computer Systems (Model-Diamond Speedstar HC), 532 Mercury Drive, Sunnyvale CA 94086. Phone: (408) 736-2000.

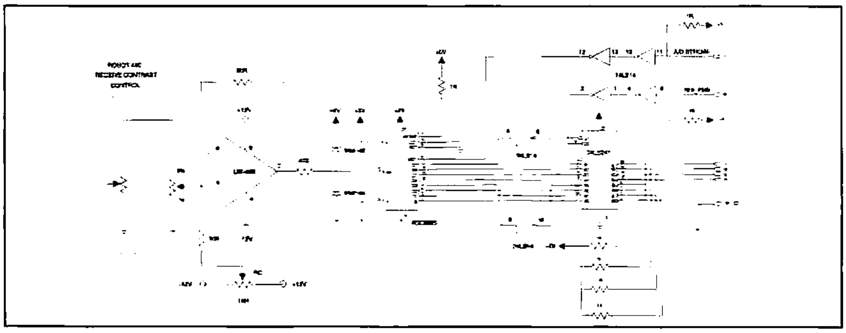


Figure 6. If you own a ROBOT 400, it can be used as a receive-only front end for the IBM PC color SSTV program. This circuit is all that is needed between the ROBOT 400 and the IBM PC parallel port for proper operation.

Table 1. Slow-Scan Formats Currently Supported

Format	Color/BW	Resolution	Comments
8 sec.	B/W	128 x 120	Send & receive
12 sec.	B/W	128 x 120	Send & receive
24 sec.	B/W	256 x 240	Send & receive
36 sec.	B/W	256 x 240	Send & receivo
72 sec.	Color	256 x 240	Send & receive
36 sec.	Color	256 x 240	Send & receive
S1	Color	256 x 256	Receive only*
S2	Color	256 x 256	Receive only*
M1	Color	256 x 256	Receive only
M2	Color	256 x 256	Receive only

*Software to transmit in these modes is being tested and will be available from KA2PYJ soon.

wee hours of many a late night, and to W3LDS, WB2YRH, WB4OQ, K4FJK, N4TZJ, KF4ZC, WA3YAH and KA8LWR who wired and tested the first prototypes.

I hope that this project allows many of you to participate in this exciting operating mode. As a courtesy to stations that operate in other modes, SSTVers try to restrict their operations to 3.845, 7.181, 14.230, 14.233, 21.340 and 28.680 MHz. Hence, you will find it very easy to make a contact at almost any hour of the day on these frequencies. Please keep in mind that there are often dozens of stations listening in and patiently waiting their turn to send a picture or to receive others'. Please exercise your best operating practices so that we can all continue to enjoy this fantastic hobby. "See" you on the radio!

The Compact-A-Loop Antenna

80 meters for the apartment dweller.

by Richard Q. Marris G2BZQ

Many of us dream of a super all-band antenna farm. There is nothing wrong with this dream if you have the odd acre or two of real estate way out in the sticks. Good luck to those fortunate few. Many of us will have to rely on an unexpected windfall to provide the necessary shekels to achieve this dream. However, while waiting for the windfall, amateur transmitting life must go on. Many hams suffer from lack of space, from official and other diabolical restrictions, and often from a poor ground. The best idea is to design/tailor-make the best possible antenna to fit the existing space available. Such is the Compact-A-Loop.

I designed the Compact-A-Loop by experimenting with various 80 meter band horizontal loop configurations not needing any RF ground. It fits into a room with the transmitter located on a desk in the corner, and is easily adaptable for outdoors space.

Figure 1 shows the final Loop circuit, which is a horizontal delta shape with a 42' circumference (3' x 14' sides). The Loop can be resonated via a 2-gang variable capacitor (C3 and C4), and covers the whole 80 meter band (3500-3800 kHz). In parallel are ballast capacitors C2 and C5 (discussed later in this article). Connection to the 50 ohm impedance feedline is via C1, which is a coupling/matching capacitor. The usable bandwidth, without retuning, on the prototype is approximately +/-20 kHz of selected frequency. I tried other horizontal loop shapes, including square, rectangular, and some very irregular multisided shapes. The frequency range changed in all cases, and the bandwidth was narrower, down to +/-3 kHz in one case. Furthermore, to add to the complexity, the proximity of nearby objects affected both frequency range and bandwidth. Extensive experiments indicated that the final delta shape was way ahead of the other shapes. One very obvious reason for this is that it is possible to keep all 3' x 14' long sides well away from the walls (see Figure 2) and other objects. This gave the best usable bandwidth, best transmitter loading and range, and best received signals. Low RF power output of 7 or 8 watts CW was used in all tests, and is used in operation. No harmonic radiation or TVI was detectable.

The Loop is omnidirectional with a useful forward "hump" on B around the junction of B and C. Figure 2 shows how this "hump" has been oriented approximately east southeast,

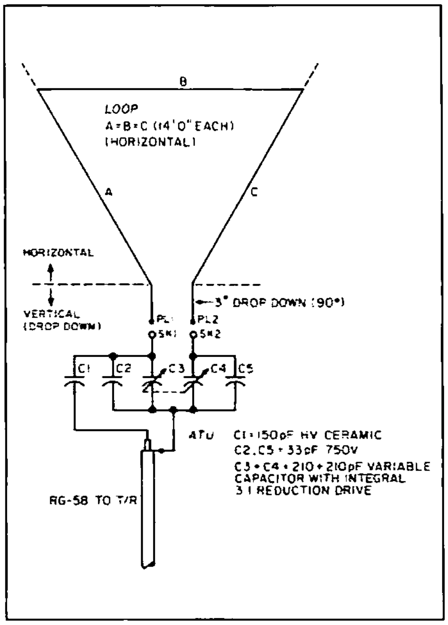


Figure 1. Diagram of the Compact-A-Loop.

giving a small peak right across Europe and well into the USSR. Ideally, this small peak should point westward to get maximum signals to North America, but this was not possible here. Apart from this small peak, the Loop is omnidirectional.

Construction

The Loop consists of 42' of white stranded #20 PVC covered wire This is quite adequate for low power operation. You may want to use larger diameter wire for higher power outdoor operation. The Loop was erected with three equal sides (A + B + C). It is held 10" below the ceiling, and is supported by lengths of 8 lb. breaking strain nylon fishing line which, along with the white PVC wire, is inconspicuous against a white ceiling. Figure 4 shows a space-saving compressed version, still using 42 feet of wire (discussed later).

The ends of A and C are dropped down 3" (Figure 2) and fitted with 4mm plugs (PL1 and PL2) to plug into the top of the tuning unit (Figure 3).

The Tuning Assembly

The tuning unit (Figures 1 and 3) is somewhat unusual. It is assembled into a plastic box raised from the operating desk by a vertical post so that the top is just below the apex of the loop, which plugs into sockets SK1 and SK2. A 1/4" (6mm) diameter wood dowel remote control shaft drops down so that the control knob is conveniently reached by just raising your left hand a few inches off the desk. The resonating variable capacitor (C3 and C4) is a 2-gang 210 + 210 pF with integral 3:1 reduction drive. An alternative would be to use another make and fit an external slow motion drive. C2 and C5 are 33 pF (750 volt) silver mica ballast capacitors, selected to ensure that the 80 meter band is fully covered. Alternative values, up to +/-15 pF, may be required if the Loop configuration is changed in shape. The frequency range may be affected slightly by the proximity of surrounding objects.

Coupling/matching capacitor C1 is a 150 pF ceramic (1 kV). It couples one end of the Loop to 5 feet of RG58 coaxial 50 ohm impedance feedline, which exits through a hole in the rear of the box, and is cleated at the back of the vertical post, down to the transmitter/receiver. In original tests C1 was a 250 pF variable capacitor—however, I found that 150 pF (on the VC) was optimum and not critical, so a fixed capacitor was substituted.

The tuning unit layout is shown in Figure 3a, and the actual mounting used here is in Figure 3b. The mounting can be adapted to suit individual requirements. If the Loop is erected in a loft or outdoors, a remote tuning arrangement will have to be devised. If the Loop is erected outdoors, it should be possible to put the tuning unit just inside a window. The plastic box I used had a metal panel which was replaced with a small piece of plastic sheet.

Operation and Results

The resonating capacitors C3 and C4 are tuned for maximum signal on "receive" at the desired frequency. For example, here it is often resonated at 3550 kHz, giving a usable range of 3530-3570 kHz without retuning C3 and C4. The transmitter is loaded into a dummy 50 ohm load in the usual way. On "transmit" with the Loop connected, only a very minor adjustment of C3 and C4 and transmitter loading may be needed—if at all. The frequency range can rapidly be achieved by adjusting C3 and C4.

I made a first tentative CQ at 0400, using 7 watts CW output when the conditions were

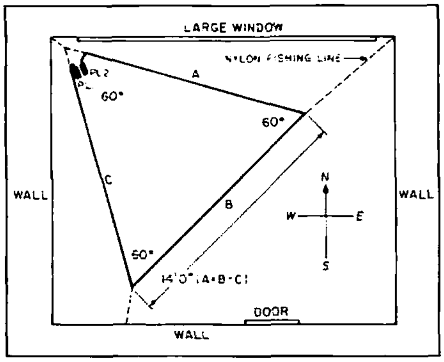
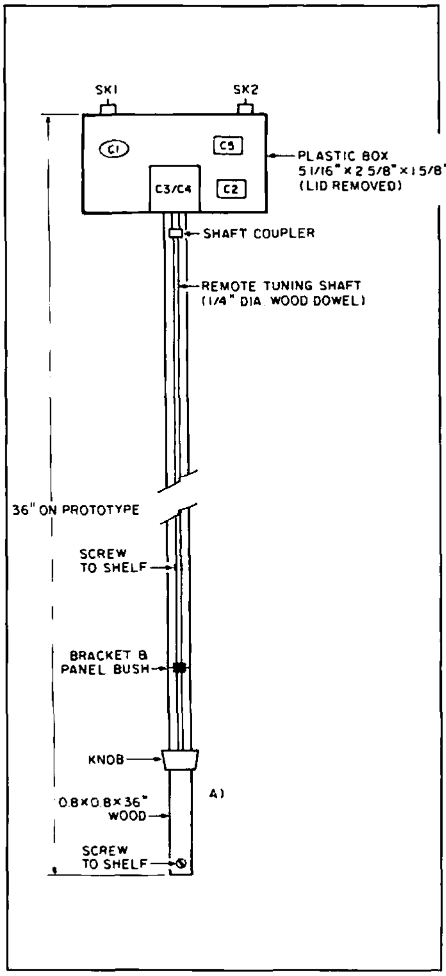


Figure 2. Installation of the Loop.



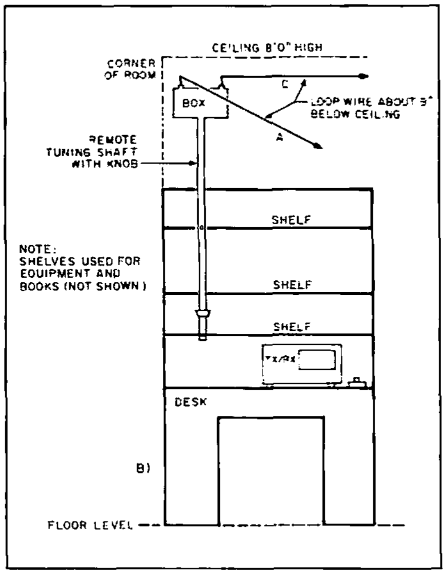


Figure 3. a) Tuning unit (with remote tuning shaft). b) Configuration used on the prototype.

Parts List

C3, C4	210 + 210 pF	2-gang variable capacitor with integral 3:1 reduction drive
C2, C5	33 pF 750 volt	Silver mica capacitor (see text)
C1	150 pF 1 kV	Ceramic disc
Loop	A+B+C is 42 feet of white #20 PVC covered stranded wire (larger diameter wire is advisable for outdoor installations.).	
PL1/PL2	4mm	Banana plugs
SK1/SK2	4mm	Banana sockets
Box	Plastic box 5-1/16" x 2-5/8" x 1-5/8" Tandy (Radio Shack), (120 x 65 x 40 mm). Cat. No. 270-233 Metal lid replaced (see text)	
Feedline	RG58 coaxial	Approx. 60" used
Tuning	1/4" (6mm) wood dowel to required length	
Shaft	(36" used on prototype) + shaft coupler + bracket and panel bush and knob	

bad. It was immediately answered by a station about 1,000 miles away. Though his signal was very weak, he gave an excellent report. Subsequent operating results were quite excellent between 0300 and 0500, several mornings per week.

Let me stress that this Loop, as described, is a low-power antenna for indoor use. *High power, indoors, can be dangerous and may be lethal.* If the Loop is erected outdoors, then higher power can be used. The wire gauge should be increased, and possibly higher voltage rating capacitors should be used.

Ideas

The results obtained with the configurations shown in Figures 1 and 2 indicate that the high voltage points are on Loop arm A; B and C give maximum radiation. It is well worth trying a reversal of PL1 and 2 in SK 1 and 2.

During experiments I tried a compressed version of the Compact-A-Loop (see Figure 4). The effective area taken up by the Loop was reduced by about 20/25%. Various angles were tried (AB) from 45 to 70 degrees. The usable bandwidth was about +/-15 kHz and an extra 15 pF was added to C2 and C5. This was still a very usable antenna.

I didn't try this Loop on other bands, but you would have little difficulty in adapting the design for this purpose.

Conclusion

This Loop antenna is a very useful, efficient, low-power device for the TXer with restricted space who wants to work on the 80 meter band. It is low cost, quick to erect, and has very obvious potential for the experimenter. It has given excellent results with no measurable harmonic radiation and no TVI on a TV receiver very near.

ATV Transmitter, Part I.

Get on ATV easily. and cheaply.

by William Sheets K2MQJ and Rudolf F. Graf KA2CWL

The "video revolution" of the last decade has made available to the average ham low-cost cameras and excellent low-cost video monitors. With a suitable transmitter, a simple downconverter, and a yagi or other antenna suitable for 430 MHz use, it is a fairly simple matter to get on ATV without mortgaging your house or cramming the shack with large surplus "boat anchor" broadcast equipment.

This article will describe a simple, efficient ATV transmitter for the 420-450 MHz band (70cm). It is roughly the size of a pack of cigarettes and runs from a 9-volt supply, delivering up to 1 watt of output (PEP), and also features full video bandwidth (5 MHz) with built-in audio subcarrier.

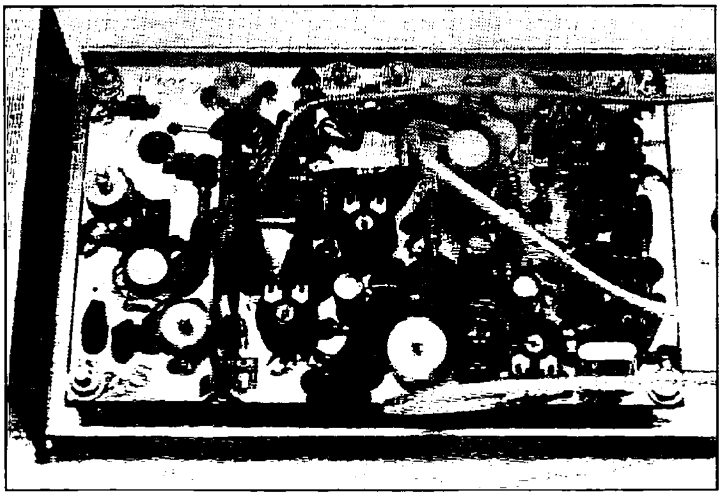


Photo. The 1-watt ATV transmitter.

Some possible amateur applications for this transmitter are:

- ATV base station exciter or low power transmitter.
- Video "lookie-talkie" handhelds, in conjunction with a small pocket TV set, downconverter, and miniature camera.
- Radio control applications: aircraft, boats, etc..
- Video links.

The ATV Transmitter

The transmitter uses 12 transistors, fits on a 2.5" x 4" (6.35cm x 10.2cm) PC board and directly interfaces with "standard" video devices. It requires 1-volt p-p, 75 ohm negative synch video (color or B/W) NTSC or PAL, and audio input can be 10 mV to 1V (line level) p-p into 5k ohm. RF output is nominally 0.75 to 1.0 watt (peak) into a 50 ohm load. It is easy to build, very reproducible and lightweight (about 60 grams or 2 ozs.). This design can operate over the range of 7 to 10 volts (9V nominal) at about 300 mA, making NiCd packs a feasible supply for portable or R/C applications. On-board audio and video level adjustments are included.

The transmitter is designed for single frequency operation, but a crystal switch can easily be added if multifrequency operation is desirable. While the NTSC system is the video format the transmitter is designed around, PAL operation is possible. Remember that the transmitter can be thought of as an AM transmitter with 5 MHz video bandwidth, and an (optional) added subcarrier at 4.5 or 5.5 MHz that can be FM modulated.

This project is also an excellent education in solid-state transmitter circuitry for those amateurs wishing to get some experience in this area. Picture quality is excellent, and minimal test equipment (VOM, 50 ohm load, 9V supply) will suffice.

When building this project, use only the parts specified in the Parts List. UHF circuits can be quite critical as to both component type and value. Also, proper parts placement is very important. Lead lengths should be very short. Anything longer than nearly zero may cause problems. Note that 10 surface mount capacitors (chips) are used, as well as ferrite beads. Also, tenth-watt (eighth-watt resistors can be substituted) resistors and miniature NPO ceramics are employed for very short leads and close component spacing. Tiny slug-tuned coils, easily made by the constructor using readily available materials, are used rather than commercial, hard-to-get, large shielded factory-made types. This gets rid of coil procurement headaches. If the dimensions are followed, no problems should result. In particular, supply bypassing is very important. We have incorporated chip capacitors to guarantee this. By keeping everything small, compact, and by using a shielded, double-sided PC board with good bypassing techniques, all the possible "horrors" associated with VHF and UHF circuitry can be easily dealt with. As long as the design is exactly duplicated there is no reason to encounter "nightmare, off-the-wall, weirdo" problems. The coils are easy to wind and the largest ones have only eight or nine turns of wire (see Figure 4 and the Table). In fact, several are only loops or pieces of wire, since inductors required at 440 MHz are usually in the 0.01 and 0.1 µH range. However, the PC board is compact. and parts are very small. A small soldering iron with a pointed

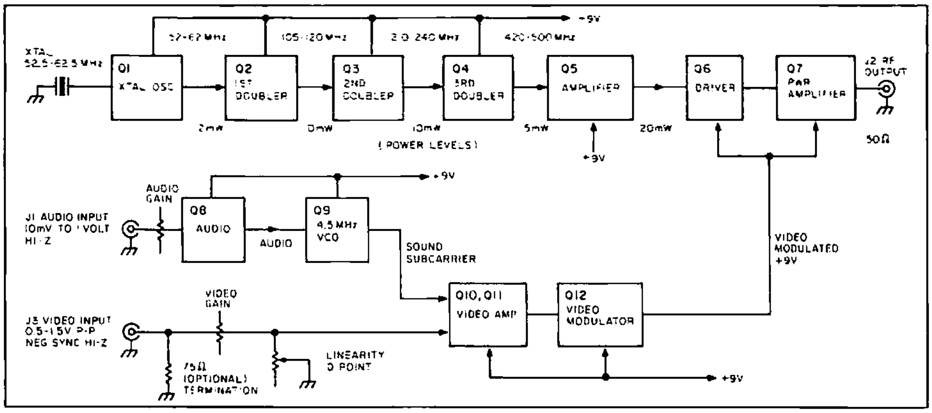


Figure 1. Video transmitter block diagram.

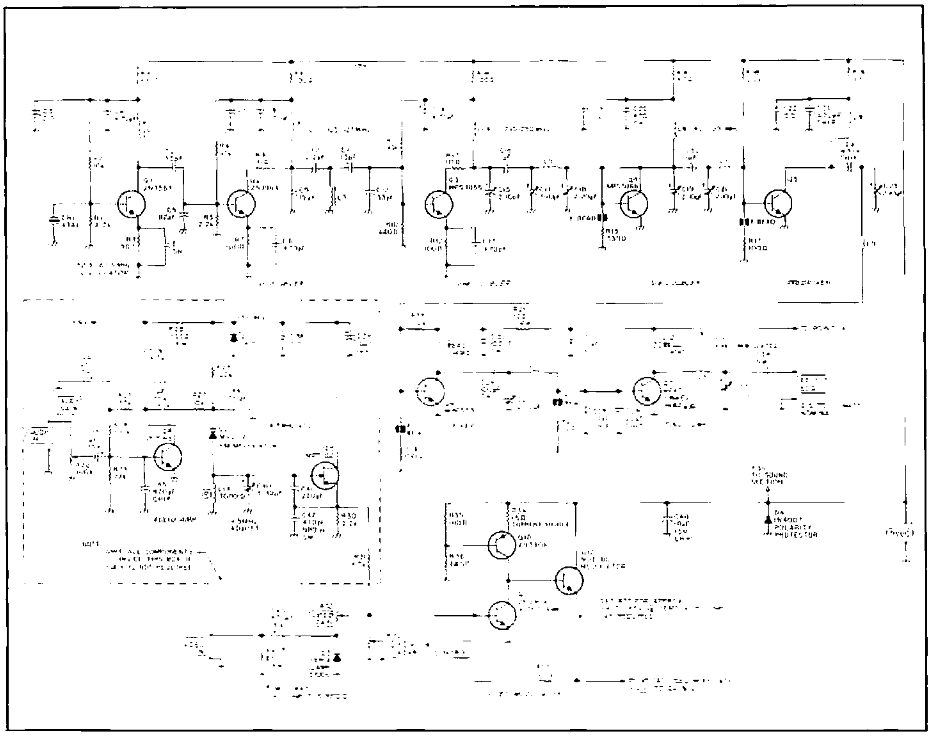


Figure 2. Schematic diagram of the 1-watt, 9-volt ATV transmitter.

tip is recommended, especially for soldering in the chip capacitors.

A discussion of precautions at VHF-UHF also appears in our February 1986 *Radio Electronics* article, "Build this Wireless Video Link." Anyone interested in building this project may find this article very informative.

Circuit Overview

The transmitter board's 1-watt level is capable of several miles of transmission range and those intending to use this design *must do so under appropriate legal circumstances and suitable licensing; this means you must have at least a Technician class amateur radio license.*

The transmitter is illustrated in block diagram form in Figure 1. Twelve transistors are employed and a 9-volt supply such as NiCds, an IC regulator, or AC-operated supply is assumed. Q1 is a crystal oscillator operating at one-eighth (1/8) of the picture carrier frequency. It is operated between 52.5 and 56.25 MHz with the circuit constants shown in Figure 2. This corresponds to a 420 to 450 MHz output frequency, which covers 430 MHz ham TV. With modification of circuit constants, higher or lower frequencies are possible, with reduced performance above 500 MHz and possibly somewhat enhanced performance below 420 MHz (more RF output), depending on the particular tran-

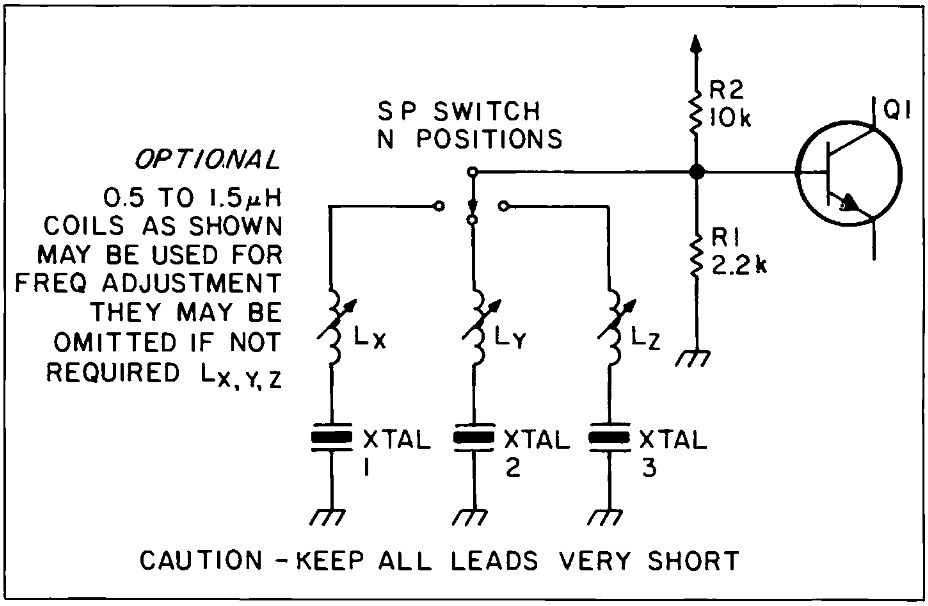


Figure 3. Scheme for XTAL switching.

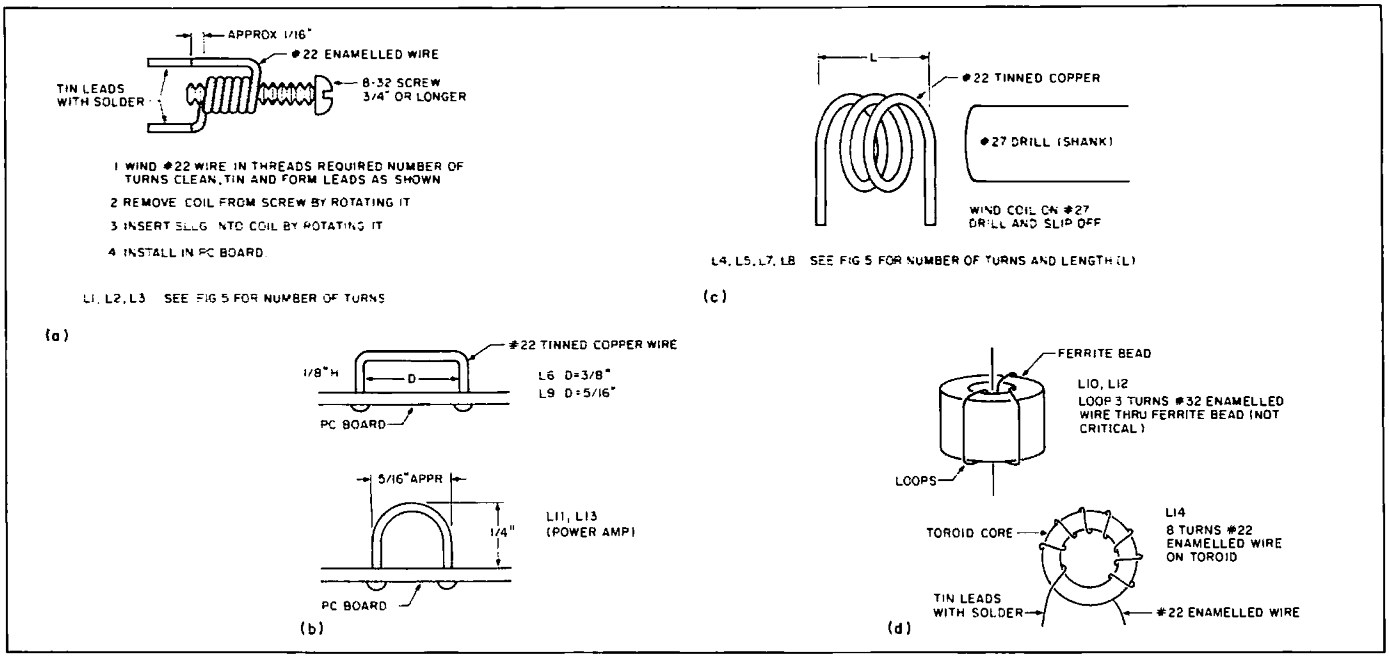


Figure 4. Coil construction.

sistors used. (This choice is left to you.)

Q2 is driven by the output of Q1 (about 2-5 milliwatts) and acts as a doubler. Q2 feeds Q3 with a signal twice the frequency of the crystal. Q3 doubles the frequency to four times crystal frequency, typically 210 to 225 MHz. Double-tuned interstage networks are used to suppress unwanted harmonics. Q4 doubles the output frequency of Q3 to the final output frequency. About five milliwatts of RF power are available. Q5 is an amplifier tuned to the output frequency. Its function is to amplify the signal at the output frequency present at the output of Q4. About 30-50 milliwatts of RF power is developed by Q5. Q6 and Q7 form a power amplifier. The power amplifier employs high gain RF semiconductors, and matching networks are adjustable for optimum tune-up. A fixed tuned strip-line design was contemplated, but at 420 MHz it would have occupied too much PC board area to comfortably fit on a 2-1/2" x 4" PC board. Use of broadband chokes and surface mount (chip) capacitors, and careful design to avoid possible low frequency spurious oscillation problems, have resulted in a very stable, efficient, reproducible circuit and you shouldn't encounter any UHF "horrors" if the design is reproduced exactly as shown, using the specified components.

Audio input at J1 from 10 millivolts (microphone) to 1 volt (line inputs, etc.) is fed to audio amplifier Q8. A level control is provided for optimum modulation adjustment. The audio modulates VCO circuit Q9, which produces a 4.5 MHz FM signal. This is the sound subcarrier. It is fed to video amplifier Q10 where it is combined with the input video signal from J3. The video input may be 0.5 to 1.5 volts p-p, negative synch. Q10 and Q11 form a video amplifier which feeds modulator Q12. Q12 is capable of producing a video signal which has 0 to +12V level swing, and can drive a load up to 1 ampere. Bandwidth at -3 dB is in excess of 10 MHz, assuring crisp picture detail. Q12 acts as a power supply to Q6 and Q7, effectively AM modulating the RF power output. A linearity control adjusts the operating point of Q12 for optimum modulation linearity. The Q point must be properly set, otherwise clipping of the video signal will occur. This will produce "burned-out" picture highlights (white areas) with loss of detail, and/or synch "buzz" in the audio, as well as loss of picture stability in extreme cases.

In ATV practice, sometimes the 4.5 MHz subcarrier is not used, but a separate "talk back" channel on the 2 meter amateur band is used instead for audio and/or liaison purposes. If you don't want the 4.5 MHz sound subcarrier, simply leave out Q8, Q9 and all VCO/audio components. This won't affect video peformance in any way and, in fact, can simplify things somewhat, since synch buzz problems will be much less likely with a separate sound transmitter, and video performance can be optimized without allowing for audio performance. However, the audio section of this transmitter is perfectly adequate for most amateur applications.

Circuit Description

Refer to Figure 2. Crystal oscillator Q1, a 2N3563 VHF NPN transistor, is biased to initially 7 volts and 5 milliamperes Q point by resistor R1, R2, and R3. Crystal CR1 acts as a series resonant "bypass" to ground only at the crystal series resonant frequency (52.5 to 56.25). At this frequency, Q1 acts as a common-base amplifier. Tuned circuit L1 and C2, in series with C5, together with stray capacitance of about 1 to 2 pF, form a load for the collector of Q1. C3 and C4 bypass the "cold" end of L1 solidly to ground for AC signals. Internal feedback from collector to emitter occurs in Q1 via the intrinsic collector-to-emitter capacitance of Q1 about 2 pF. C1, a 56 pF capacitor, forms a voltage divider to feed back a portion of collector signal to the emitter. Note that C1 is not an emitter bypass but a part of the feedback network of oscillator Q1. Therefore, at the series resonant (crystal) frequency of CR1, Q1 acts as a grounded base oscillator. An RF signal is generated at this frequency. DC is supplied to the Q1 stage through decoupling resistor R4. Collector current, once Q1 starts to oscillate, is dependent on the tuning of L1, but typically is 5-10 milliamperes. If two or more frequencies are desired, a switch can be installed (Figure 3), however, some tuning compromises may be needed if the output frequencies are more than 5 MHz apart. A portion of this voltage (about 1.5 volts RMS) across L1 is fed to Q2 by the voltage division between C2 and C5. C5, an 82 pF capacitor, has a low impedance at twice the oscillator frequency. Q2 is biased initially the same as Q1 via R5, R6 and R7. C6 is a bypass capacitor, as are C7 and C8. Q2 acts as a frequency doubler by the fact that a large drive signal from Q1 causes rectification in the emitter base junction of Q2. This produces appreciable harmonic generation. Keeping the impedance low in the E-B circuit of Q2 by using a large value (82 pF) for C5 results in efficient harmonic generation.

C7 and L2 are tuned to normally twice the crystal frequency. R9 supplies DC to Q2 stage. Tuning is accomplished via a slug in L2. C10 couples RF energy at 2X crystal frequency to a second tuned circuit, L3-C11-C12, also tuned to twice crystal frequency. Use of two tuned circuits assumes good selectivity and improved rejection of unwanted frequencies. This is important for a clean signal from the transmitter. R8, in the collector of Q2, suppresses a tendency to unwanted UHF parasitic oscillation. Q3 is fed energy at 105 to 112.5 MHz from the junction of C11 and C12. R10, R11, and R12 bias Q3. Since the RF level at the base of Q3 is high,

the RF level affects the bias. Typically, Q3 runs at 15 to 20 milliamps collector current. Q3 is an MPS 3866, a 400 MHz medium power (1-watt dissipation) plastic transistor. It offers superior performance at 250 MHz to the 2N3563 used at Q1 and Q2. Except for frequency, operation is similar to the Q2 stage. Q3 doubles the input frequency to 210 to 225 MHz. R13 suppresses UHF (>300 MHz) possibly parasitic oscillation. C15 and L4 are tuned to twice the input frequency. C14 is a 470 pF bypass capacitor. The 0.01 µF used in Q1 and Q2 is ineffective at 250 MHz and not used here, the 470 pF being sufficient. R14 feeds DC to Q3 stage. Note that now the output-tuned circuit is tuned by variable capacitor C15 and L4 is fixed. This is because slug tuning is no longer practical, the coil L4 having too few turns. C16 couples energy to tuned circuit C17, L5, and C18. This forms a double-tuned circuit at 210-225 MHz. C17 is the tuning capacitor. C18 is a variable capacitor to optimize matching into Q4, the last (third) doubler. R15, a 330 ohm resistor, with a ferrite bead to act as an RF impedance (see Figure 5) in series with it, completes the base circuit DC path for Q4. Bias now is supplied entirely by the drive signal. No extra DC bias is applied. The emitter of Q4 is directly grounded, since bypassing of emitter circuits at 420-500 MHz is difficult without some loss of RF gain. However, a low value of R15 keeps DC stability adequate.

C19 and L6 (a short length of wire is all that is needed) form a tuned circuit at 440 MHz. C19 and C20 provide low frequency (video) and RF bypassing. C19 provides little bypassing at UHF. Its purpose is to kill stray low frequency gain of the Q4 stage. C20 is a chip capacitor, the only type effective at 440 MHz. It provides a solid RF ground for the cold end of L6. The 440 MHz signal at the collector of Q4 is fed to tuned circuit C21 and L7 via C32. C21 and L7 match the low base impedance of Q5 to the collector circuit of Q4 and form a double-tuned UHF circuit together with C19 and L6. R17 and the ferrite bead provide a low DC impedance but a high RF impedance to the base of amplifier Q5. Q5 amplifies the UHF signal to about 30 milliwatts. L8 acts as an RF choke. C22 and C23 perform bypassing for video and UHF respectively. C24, a 470 pF chip, couples RF output but blocks DC from tuned circuit C25 and L9. L9 acts as a matching inductor to the base of driver transistor Q6. Q5 is fed straight, unmodulated +9 volts DC. Q6 receives the drive from Q5. R19 and the ferrite bead on one lead of it provide high RF impedance and low DC resistance to the base of Q6. Since a ferrite bead looks more like a high resistance rather than a reactance at high frequencies, the effective Q is very low. This prevents the possibility of parasitic oscillations that could occur if a conventional type solenoid wound RF choke were to be used.

C27, L11, and chip capacitors C28 and C29 match the collector impedance of Q6 and Q7. L10 is a ferrite bead choke made

with three turns of wire wound through a ferrite bead, in toroidal fashion (see Figure 4). This results in a very low Q, resistive impedance (about 1,000 ohms) and again avoids possible parasitics. C26 is a coupling capacitor, a chip to minimize stray inductance. C30 is a bypass capacitor chosen to provide a short circuit to UHF while looking like a high impedance at 10 MHz or lower, so the video signal component of this power supply voltage (modulation) is relatively unaffected. R20 is a coupling resistor. Q6 draws about 130 milliamperes current at modulation peaks (synch tips). It is an MRF559. The RF power level out of Q6 is in the range of 100-150 mW so that Q7 has sufficient drive to produce the 1 watt (PEP) nominal output. Q7, an MRF630, is similar to Q6 in its operation. R21 and the ferrite bead on one lead (see Figure 5) allow low DC base circuit resistance with high RF impedance as for Q6. L12 is an RF choke exactly the same as L10. L13 and C33 form the collector matching circuit, together with mica capacitor C34, to match the 50 ohm load impedance to the optimum collector load impedance needed by Q7. *Note that a 50 ohm load must always be present at J2.* Otherwise, Q7 may be damaged. A tolerance of +/- 50% (25 to 100 ohm) is permissible here. However, optimum performance is obtained with a 50 ohm load.

Suitable 50 ohm coax must be connected from C34 (on the PC board) to K1, with short connections (1/4" or less). Any length of coax can be used, but for best results, keep the coax short. We used RG174/U PVC type but a type such as Teflon™ coax (RG188/U) would be better. From J2, standard coax (RG58/U, etc.) will do. Remember, feedline loss can be very high at 420 MHz and up. Preferably, connect the coax, with near zero lead length, to the bottom side of the PC board, very close to C34. Solder the shield directly to the ground foil, as close to the pad connecting C34 as possible. C31 is an RF bypass. Q6 and Q7 are fed video-modulated 9 volts from Q12, which will be discussed later.

Input video from J3 (std. 1V p-p negative synch, etc.) is fed through C43 to clamp diode D3. Note that C43 is apparently incorrectly polarized. This is to allow for certain video equipment that may have a DC component of up to 16 volts present on the video output. If you do not expect to encounter this, you can reverse the polarity of C43, if you wish. The low reverse voltage (0.6 volt) appearing across it doesn't do any harm. D3 clamps the maximum negative input level to -0.7 volts and avoids serious overmodulation at synch tip level. If you wish, you can DC couple from J3 directly into R32, the video gain control, if your interfaces permit. Also, note optional 82 ohm termination resistor R32A. This resistor can be used if you want the transmitter video input to be a line termination (the usual case). Use it unless you are in a situation where loop-through (several other video loads in parallel) is required.

R32 acts as a video gain control. Video from R32 is fed to the base of video amplifier Q11. The collector of Q10 is fed by current source transistor Q10. Q10 is biased to about 50 milliamperes collector current by R34, R35, and R36. This permits the collector of Q11 to supply plenty of drive to modulate Q12 and eliminate the need for a low value resistor collector of Q11 to the power supply rail (+9V). This enables the base of Q12 to nearly approach the +9V supply level and allows a higher positive swing of the emitter of Q12 than a resistor from Q11 to +9V would permit, due to the base drive needs of Q12. Q12 an MJE180 is configured as an emitter follower. It must supply all the current to Q6, Q7, (or Q5) and must provide a very low supply impedance and very high slew rate. The low impedance is necessary for both full RF power output and control of parasitic oscillation tendencies in the Q6 and Q7 amplifier circuitry. Also, the load is capacitive, due to the bypassing from C30, C31, and also from C26. The Q12 circuit, in tests, can supply nearly 12 volts of video into a 10 ohm load with a +12V supply. (This is 1.2 amperes of current.) Q12 must be heatsinked. R37 provides feedback around the modulator to establish both Q point, video gain, and bandwidth. R33 sets the exact Q point (voltage seen at point A, the emitter of Q12), under zero drive conditions about 4 to 5 volts DC to Q6 and Q7. R33 is adjusted for maximum undistorted symmetrical video at point A, while R32 controls video drive to Q11. Supply bypassing must be effective at the collector of Q12 due to the high current, fast waveforms handled. A 10 µF 15V chip tantalum was used; conventional electrolytics were found to be somewhat less effective at C44, the main supply bypass capacitor. A diode D4, a 1N4007, is provided to serve as reverse polarity protection. Connect it directly across the +9V line to the transmitter board. It can be omitted if there is no possibility of supply reversal, and you are perfect and never make mistakes. Audio is fed to gain control R22 from jack J3. Input level is between 10 millivolts to 1 volt at high impedance, allowing direct interfacing with most microphones or other audio sources. Audio from R22 is fed through coupling capacitor C35 to Q8, a 2N3565. Q8 is biased from R25, R24, and R23. C36 is a bypass capacitor to prevent audio degenerative feedback and loss of gain. Collector load resistor R26 supplies DC to Q8. C37 couples audio to R27, and blocks DC. Note that no pre-emphasis (the providing of high frequency boost) has been used. If you want to use it, for better high frequency audio response change C37 to 0.001 µF and set the gain control R22 up higher to compensate for loss. We found we did not need it in our application, the audio being adequate. R27 couples audio to varactor diode D2, an MV2112 or MV2113. R29 provides DC bias of +5V to the varactor. The varactor diode varies the capacitance of D2 (56 pF at 4 volts, about 50 pF at 5 volts bias) at an audio rate. The capacitance of D2 appears across the 4.5 MHz oscillator coil, L14. Q9, an MPF102 FET, together with capacitors C41, C42, C40, and L14 form a Colpitts type RF oscillator operating at 4.5 MHz. C40 is a trimmer (variable) capacitor to set the frequency to exactly 4.5 MHz. L14 is a toroidal coil to minimize both size and stray magnetic field generation. C46 provides RF grounding for D2 while blocking audio.

When D2 changes capacitance, the oscillator frequency shifts. Therefore, an audio voltage component on DC causes a frequen-

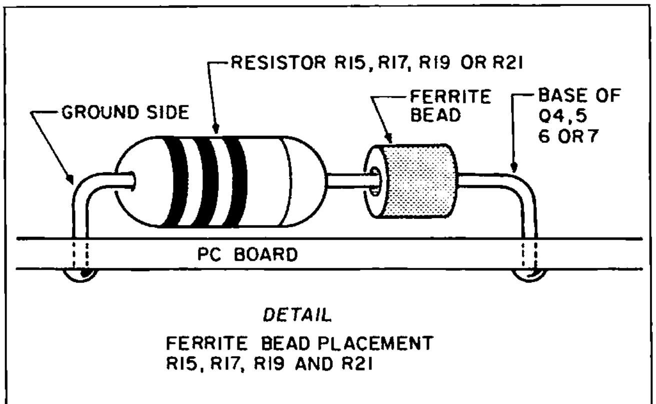


Figure 5. Using an RF choke on resistor leads.

Table 1. Coil Winding Data

Coil	Description (# Turns, Length)	Form	Notes
L1	9-1/2 turns #22EN	8-32 screw	Slug reqd.
L2	3-1/2 turns #22EN	8-32 screw	Slug reqd.
L3	4-1/2 turns #22EN	8-32 screw	Slug reqd.
L4	3 turns #22 tinned	#27 drill	1/4" long
L5	4 turns #22 tinned	#27 drill	1/4" long
L7	1-1/2 turns #22 tinned	#27 drill	1/16" long
L8	2-1/2 turns #22 tinned	#27 drill	3/16" long
L6,L9,L11,L13	Less than 1 turn	PC board	Per Figure 4
L10,L12	Bead choice, #32EN	Ferrite bead	Per Figure 4
L14	8 turns #22 on 768T188 toroid	Toroidal Core	NTSC 4.5 MHz Sound
	6 turns #22 on 768T188 Toroid		PAL 5.5 MHz Sound

Note: All coils may require plus or minus a turn due to normal variation and construction. (This is to be expected.) Due to individual tolerances, construction techniques L1 through L3 may require plus or minus one turn. This may be true of L14. L4, 5, 6 and 7 may have to be spread or squeezed lengthwise. Dimensions shown are from an average of five units and yours therefore can vary to some degree.

Parts List

Resistors: 1/8 or 1/10W

P/N	Value
R1,R5,R38,R39,R30	2.2k ohm
R2,R6,R11,R27	10k ohm
R3	150 ohm
R4,R7,R9,R12,R14, R17,R19,R35	100 ohm
R8,R13	10 ohm
R10,R36	680 ohm
R15	330 ohm
R16	47 ohm
R18	33 ohm
R20	10ohm 1/4W
R21	22 ohm
R22	100k pot
R23	22k ohm
R24,R29	100k ohm
R26,R31	4.7k ohm
R27	10k ohm
R28	330 ohm 1/4W
R32,R33	1k ohm pot
R34	15 ohm
R37	3.3k ohm
R40	82 ohm 1/4W

Capacitors:

Capacitor	Type
C1	56 pF NPO
C2,C12	33 pF NPO
C3,C7,C19,C22,C38	0.01 µF disc
C4,C6,C8,C13,C14	470 µF disc
C5	82 pF
C9,C11	15 pF
C10	2.2 pF
C15,C17,C19,C21, C25,C27,C33	2-10 pF trimmer
C16,C32	1 pF NPO
C18	2-18 pF trimmer
C20,C23,C24,C45	470 pF chip
C26,C30,C31	100 pF chip
C28,C29	2.2 pF chip
C34	5 pF mica
C35,C36,C37	1 µF/(35 or 50V) electrolytic
C39	10 µF/16V electrolytic
C40	3-40 pF trimmer
C41	220 pF NPO
C42	470 pF NPO
C43	470 uF/16V electrolytic
C44	10 uF/15V chip tantalum
C46	100 pF NPO

Semiconductors:

Q1,Q2	2N3563 transistor
Q3,Q4,Q5	MPS3866 transistor
Q6	MRF559 transistor
Q7	MRF630 transistor
Q8	2N3565 transistor
Q9	MPF102 transistor
Q10	2N3906 transistor
Q11	2N3904 transistor
Q12	MJE180 transistor
D1	1N757 diode
D2	MV2112 varactor diode
D3	1N914 diode
D4	1N4007 diode

Inductors:

L1 - L14	See the Coil Table

Miscellaneous

1 toroid 76T188
6 ferrite beads
3 blue slugs (Cambion)
1 PC board
1 T0220 insulator
1 4-40 screw, nul, lockwasher
1 8-32 screw 1" (for winding of coils)
2 ft. #22 enameled wire
2 ft. #22 tinned wire
2 ft. #32 enameled wire
1 crystal 52.5 - 55 MHz

Note 1: Kits consisting of the PC board and *all* parts that mount on the board, including all necessary wire, are available from North Country Radio P.O. Box 53H, Wykagyl Station, New Rochelle NY 10804. The 1-watt ATV transmitter kit + crystal for 439.25 MHz is available for $112 + $3.50 postage/handling. Crystals for 434.0, 426.25 or 421.25* MHz are an additional $7.50 each. A 12-volt version of the ATV transmitter capable of a 2 watt output (similar in design to the 9-volt version - see the June/July '89 issues of Radio Electronics for details) is available for $110 + $3.50 p/h with ATV crystal. A metal case (5-1/2" x 3" x 1-1/4") suitable for the 9-volt or 12-volt versions of the transmitter complete with one power, one BNC and two RCA connectors is also available for an additional $15. To help you assemble a complete ATV station, two other items are also available: an ATV linear amplifier to boost your output power to 10 watts for $79.50 + $3.50 p/h (includes case, heat sink and all connectors and hardware) and a low noise (1.5 dB typical) ATV downconverter kit to enable reception of ATV signals using a standard TV set for $59.50 + $3.50 p/h.

*NOTE 2: Operation on 421.25 MHz requires use of a VSB (Vestigial Sideband) filter (not available from North Country Radio but supplied by others) to prevent LSB components from being radiated outside of the band limits.

cy modulation (FM) of the 4.5 MHz signal generated in the Q9 circuit. R30 provides operating bias for Q9. Resistor R31, a 15k ohm resistor, couples this sound subcarrier (4.5 MHz FM signal) into the video amplifier, which modulates it onto the RF signal along with the video.

R28, zener diode D1, and bypass capacitors C38 and C39 supply a regulated +5.1 volt nominal DC voltage to Q9 and varactor D1. The regulation reduces or eliminates oscillator drift if the supply voltage were to vary. A frequency counter can be connected to point A to set C40 to exactly the value needed for 4.5 MHz sound subcarrier frequency.

If PAL operation is contemplated, simply modify L14 as described in the Table. The audio circuit has sufficient drive for the deviation required. Simply replace the 4.5 MHz mentioned in this text with 5.5 MHz as applicable.

Stay Tuned

Next month in Part II, we'll go over the final construction of the ATV transmitter PC board and tune-up of the circuit. 73

Number 7 on your Feedback card

The Explorer

HF receiver for 40 and 80 meters.

by Paul G. Daulton K5WMS

Here is a unique application for the Signetics TDA7000 FM Receiver chip: as a two-band, 80 and 40 meter, CW and SSB receiver. How, you are asking, do you receive CW and SSB on an FM system? I only used the oscillator and mixer sections as an on-frequency product detector or direct conversion receiver. Performance exceeds existing designs using the NE602. There is no kit available for this receiver, but sufficient information is given in this article to duplicate what I have done or to design your own receiver.

Photo A. Final version of the Explorer HF receiver with the cover removed.

NE-602 Designs

Direct conversion receivers using the Signetics NE-602 IC chips have made quite a stir with home builders in the last three or four years. Basically a double-balanced mixer with an on-board oscillator and associated regulator components, the NE-602 in combination with a 50 or 250 mW audio amplifier makes an excellent direct conversion receiver with only a minimum of support components. I have built two of the Neophyte receivers (*QST*, February 1988), the Ramsey HR-8080 kit, and a couple of home-brew designs. The Sudden Receiver in the October 1991 *73 Magazine* is another fine example of an NE602 application.

Direct conversion receivers using the NE602 and LM386 do have a couple of drawbacks. The worst is lack of dynamic range. Most designs provide for an attenuator pot on the input. The operator must constantly ride the gain, say when listening to a round table on 75 meters when the stronger signals drive the 602 into distortion. Second, the NE602 with an LM386 audio output stage has insufficient volume to drive a speaker to a comfortable listening level. The NE602 has a maximum voltage rating of 8 volts.

The TDA7000 Advantage

The TDA7000 operates at 12 volts. This, in combination with an LM386 output stage, has plenty of audio to drive a 3" or 4" speaker. Front-end overload is not a problem. The TDA7000 was designed as a receiver front end for cordless phones, Walkman radios, and the like. The NE602, on the other hand, was designed as a second IF for cellular phones where it operates in a more steady-state condition.

Just by coincidence I noticed the similarity of the NE602 to the TDA7000. The TDA7000 is an 18-pin dip with a mixer, an oscillator, and two op amps for audio frequency (70 kHz) IF stages, muting, and FM detector stages. I built the first prototype on a Radio Shack experimenter's socket, using only the oscillator and mixer of the TDA7000. For audio I used a Radio Shack mini-amplifier speaker. Coils were wound for 80 meters on 1" sections of the barrel of a BIC pen. This only took about 20 minutes to throw together. Performance of the first prototype was so good I quickly (in 45 minutes) transferred the parts to a perfboard, adding a VFO coil for 40 meters. All this took place between 10 p.m. and midnight on a Saturday night.

Performance of the prototype TDA7000 receiver was better than the other direct conversion receivers I have built using the NE602. I was particularly interested in developing a design that could be given to the local Explorer Scouts, something that the youngsters could build even if they had to buy the parts one piece at a time. As a result, I've tried to specify parts that are available at a local Radio Shack store.

The only parts in this design not available

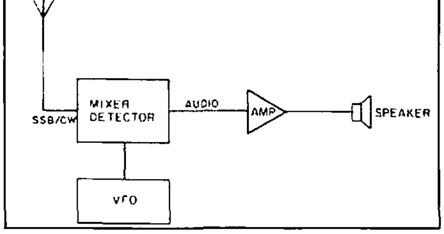


Figure 1. Diagram of the basic direct conversion receiver.

at Radio Shack stores are the TDA7000, the varicap diode, and the vernier dial drive. Although Radio Shack used to carry the TDA7000 IC, they discontinued carrying it while I was designing this circuit. However, DC Electronics, phone no: (800) 423-0070, in Scottsdale, Arizona, lists this device for \$5.95 in their recent catalog. This is about \$3 more than the NE602, but the extra cost is more than offset by the increased performance and circuit simplicity. The varicap diode is an ECG replacement and can be ordered through most Radio Shack stores, or with a change in layout a 365 pF air variable could be used in its place. The dial drive and tuning cap are a matter of builder's choice. I suggest a sturdy double-bearing capacitor for the VFO tuning cap. This could be salvaged from an old tube-type AM radio. An alternate for the tuning cap using the 440 pF ECG618 varicap and a potentiometer is shown on the schematic diagram.

Construction

The final version presented here was built in a RS# 270-274 cabinet with dimensions of 3-1/16" x 8-1/4" x 6-1/8". This is the minimum size I would recommend for a small receiver of this sort. You need panel space for a reasonable size dial and room to operate the controls. The main tuning dial is a vernier drive of unknown origin, with a brass wire for a pointer. A 3" x 5" file card was cut down and lettered for the scale. This is held in place with vinyl tape. I tried to duplicate the look of the old National MCN dial assembly that was so popular back in the '50s and '60s. Dry transfer letters were used on the panel, with an overspray of clear acrylic aerosol. The speaker grill is a piece of material called plastic canvas, available at most discount retail and craft stores. A word of caution is in order if you plan to mount the speaker in the Radio Shack cabinet. Find an electrician with a hydraulic operated knockout punch to make the hole. This cabinet is made of a very tough, thin, spring steel. I ruined a fly cutter and a hole saw trying to make the hole for the speaker. Either punch a large hole or drill a grid of small holes for the speaker.

I used a 3" x 4" piece of copper-clad phenolic, glued to the bottom of the cabinet, copper face up, to mount the components and terminal strips. All ground connections are made to the copper foil. IC sockets were

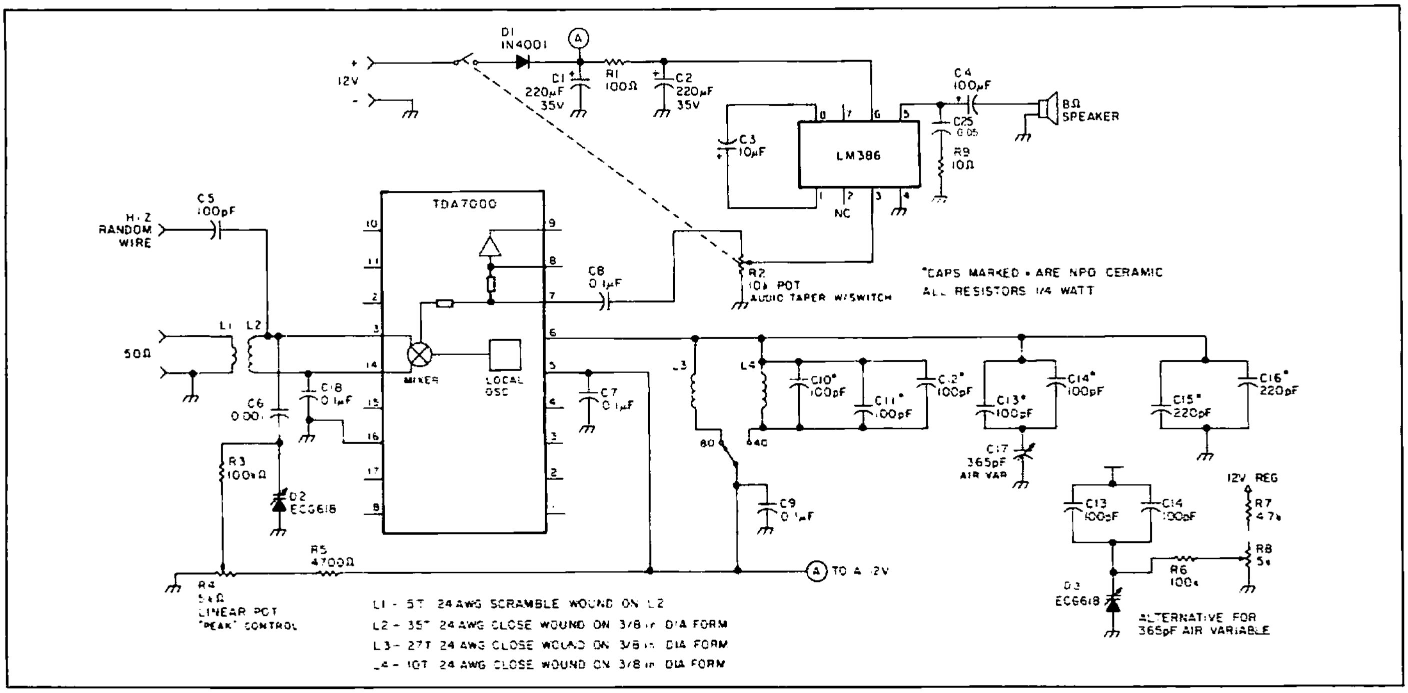


Figure 2. Schematic diagram of the Explorer 80 and 40 meter receiver.

soldered to RS part no. 276-159A IC experimenter's boards. Note from the pictures that this board is turned upside down for easy access to the solder terminals, and mounted on stand-off bushings. You could also glue this to the copper foil with a piece of insulating material between the board and the foil to prevent shorts caused by solder leaking through the holes. This type of construction was popularized by Bill Hoisington K1CLL back in the 1960s in many *73 Magazine* articles.

Solid conductor wire was used for point-to-point wiring. Twisted pairs were used on the leads going to the audio gain control to eliminate hum. Bandswitching is accomplished by switching only the VFO coils. The two-terminal oscillator circuit of the TDA7000 simplifies this. A varactor diode tunes the antenna coil to the desired band.

With the values shown, this coil will tune from 3 to 11 MHz. It would be very simple to add 30 meters to this receiver with the appropriate coil and capacitor values in the VFO section. Both 50 ohm link coupling and a high impedance input are provided on the receiver input. I originally intended to build an active antenna stage into this receiver, but I found this was not necessary. It will perform amazingly well with a 3' to 15' piece of wire connected to the Hi-Z input.

Coils

I wound my coils on plastic tubing purchased at a local hobby shop. Glue or tape the first turn down, wind the coil with a couple of extra turns, and coat the coil with clear fingernail polish. It may seem strange not to have any adjustment on the coils or trimmer capacitors for calibration, but once you have the VFO in operation it only takes a few minutes to adjust the tuning range by peeling one turn at a time off the coils or soldering fixed values of capacitance to raise and lower the tuning range. Lowering the inductance by peeling off turns raises the frequency and increases the range of bandspread from minimum to maximum capacity of the VFO capacitor. Adding capacity in parallel to the VFO coil produces the opposite effect. I made the dial scale to match what I wound up with. I mounted the coils vertically by gluing the ends to the copper-clad surface with Super-Glue.

Photo B. Top view of TDA7000 receiver board (left) and the audio amplifier board (right). Antenna coil is shown in the upper left and the VFO coils are shown in the lower left. All sockets and components are mounted on the copper foil side of the prototype board (available from Radio Shack). The extra IC socket on the audio board is for future expansion.

Audio

If you want you can omit the LM386 audio stage and purchase a mini-amplifier speaker, RS part no. 277-1008, or use whatever audio amp you have available. I used one of the op amp IF stages in the TDA7000 for audio selectivity, then later both op amps (see Figure 3). The first is a Salien-Key low-pass filter with a cutoff frequency of 2000 Hz. The second op amp is a bandpass filter. Components were selected to give a bandpass of 300 to 2500 Hz for SSB reception. Formulas for using the op amp IF filters are available from Signetics. Radio Shack included an application data sheet with their TDA7000. This data is available in the 1988 Archer semiconductor application manual. I would suggest you build the receiver as shown in the main schematic before proceeding with the audio filters. Dave N5KRN runs the output of his receiver into a Kenwood audio graphic equalizer and then to a 2 watt audio amp with a pair of large speakers. You have to hear this combination to believe the quality. [*Ed.Note: use only C8 if no filter is used, C8A for the low-pass filter or C8B for the bandpass filter.*]

Performance

Minimum discernible signal as best as I can measure is less than 0.2 microvolts. My ancient Measurements Model 80 is not RF tight enough to measure this weak a signal. The figure of 0.2 microvolts was arrived at by "hardening" the generator output with a 20 dB pad and scaling back to arrive at the MDS of 0.2 microvolts. Stability is quite good. All caps used in the frequency-determining circuits were NPO disk ceramic. Use polystyrene or silver mica types if you wish. For daytime operation I generally use a dipole antenna connected to the 50 ohm input. At night when signals are much stronger I use a random wire 3' to 15' in length con-

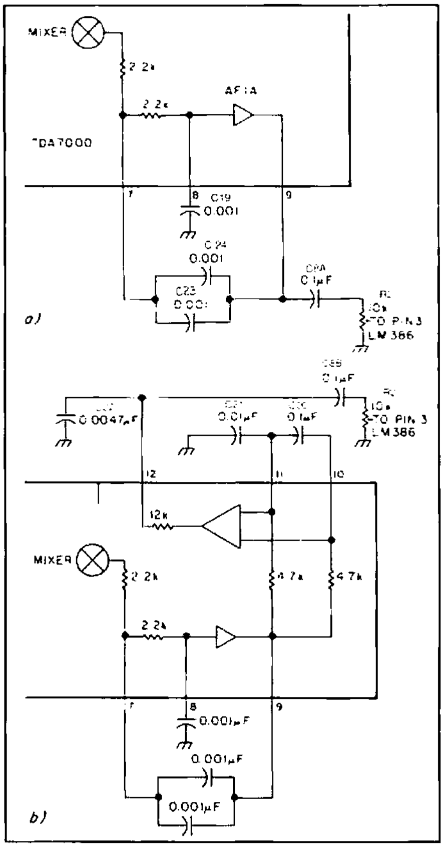


Figure 3. Schematic diagram for alternate audio selectivity using the internal op amps in the TDA7000.

Parts List

U1	TDA7000 receiver IC
U2	LM386 audio amplifier IC
D1	1N4001 diode
D2	ECG618 varicap diode
R1	100 ohm resistor
R2	10k potentiometer, audio taper with switch
R3	100k resistor
R4	5k linear potentiometer
R5	4.7k resistor
C1,C2	220 µF/35V electrolytic capacitor
C3	10 µF electrolytic capacitor
C4	100 µF electrolytic capacitor
C5	100 pF disc ceramic
C6,C19*, C23*, C24*	0.001 µF disc ceramic
C7,C8, C9,C20*	0.1 µF disc ceramic
C10,C11, C12,C13,C14	100 pF NPO disc ceramic
C15,C16	220 pF NPO disc ceramic
C21*	0.01µF disc ceramic
C22*	0.0047 µF disc ceramic
C17	365 pF variable capacitor
Alternative to 365 pF variable:	
R6	100k resistor
R7	4.7k resistor
R8	5k potentiometer
C13,C14	100 pF NPO disc ceramic
D3	ECG618 varicap diode

*** Optional filter components**

An etched and drilled PC board is available for $4.50 + 1.50 shipping/handling from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The TDA7000 is available for $5.95 from DC Electronics, P.O.Box 3203, Scottsdale AZ 85271. Phone: (800) 423-0070 or (602) 945-7736.

nected to the Hi-Z input. This helps cut down the trash and QRM. While experimenting with this I have had the TDA7000 operating from 160 to 15 meters with good results.

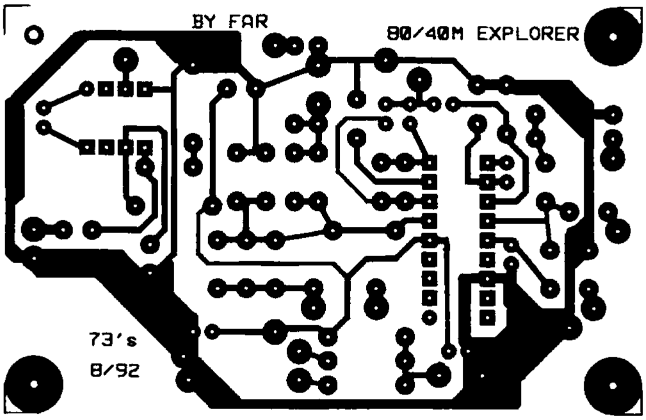


Figure 4. The optional PC board foil pattern.

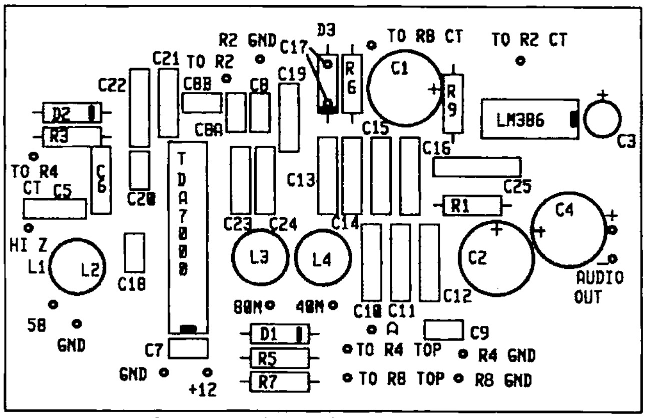


Figure 5. PC board parts placement.

Have fun with this project. As I stated in the beginning, no kit is available, nor is any planned.[*Ed. Note: A PC board is available, see the parts list for details.*] I drive an 18-wheeler for a living and I am gone three to five nights a week, so I don't have the time to pursue a kit project. I wrote this article at the urging of some of my ham friends, because this application for the TDA7000 is too good to sit on and not get the word out to other experimenters. I hope that this article will inspire some of the better builders to use the TDA7000 as I have done and develop a good kit on a PC board with premanufactured coils and such. If someone does I'll be one of the first to buy one! My thanks to Dave Burke N5KRN and Bill Allsop W5TJY for their help and encouragement in this project.

Digital ALC

A simple way to get the best out of any transmitter.

by Ed. C. Miller N7APE

A lot of ham shacks have one or more good old transmitters or transceivers that lack automatic modulation control. Here is a universal mike level unit that features the latest in digital audio control. It will work with almost any transmitter/mike combination to provide consistent full modulation, over a range of up to 12 dB. It's the way to get the best performance from any transmitter, without any internal wiring change.

Because no one consistently talks at the same loudness, and/or at the same distance from the microphone, some form of automatic level control is almost a must. For anyone who has an older rig and would like to make the best use of it, this outboard, mike-level Automatic Digital Level controller might be the answer. The ADLC is a new approach to automatic audio level control. It represents a better way to keep the peak modulation levels constant.

The Circuit

Most ALC circuits are a variation of Figure 1a or 1b. Because an increase in the output of the variable-gain amplifier above a certain level reduces the amplifier's gain, its output is reduced—not to the level just before the "knee" is reached, but slightly more. Thus, the output level will continue to rise, if only about 1 dB, over a 10 dB range of input above the compression level. If the modulation is set at 85 percent, for example, the actual modulation percentage will generally increase to about 95 percent at 10 dB of compression.

Other things that must be considered in such a circuit are the attack and release times of the gain control circuit. The attack time, which must be very short to prevent any portion of the audio peaks from exceeding the pre-set limits, is primarily deter-

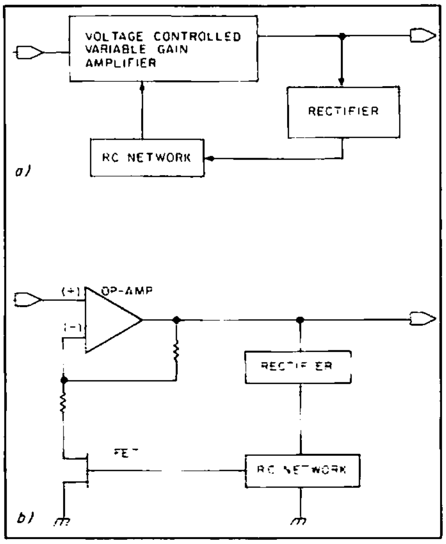


Figure 1a, 1b. Block diagrams of standard ALC circuits.

mined by the value of C in the RC network, the output resistance of the amplifier, and the forward resistance of the rectifier. The release time is determined primarily by the values of C and R. To get the desired fast attack and slow release, the reverse resistance of the rectifier and the input resistance of the amplifier become limiting factors. Also, both of these values become lower with an increase in temperature. And, as C1 is discharged at a non-linear rate, compromises must be made in the values of both C and R.

The digital ALC circuit shown in the block diagram of Figure 2, and schematically in Figure 3, overcomes these problems by using two comparators: one to establish the maximum output, and another set of about 1/2 dB below the first. Whenever the audio input level is sufficient to activate the first comparator, two things occur: The 4029 counter Up/Down input is switched to UP; and a high speed (300 kHz) pulse generator (one section of a 4093B) activates the clock input of the 4029. The 4029 outputs (Q1, Q2, Q3, and Q4) enable individual sections of the quad bi-directional audio switches. These switches each control gain-reduction pads, in 3/4 dB increments, in and between the op-amp stages.

Therefore, gain reduction of up to 12 dB is attained by reducing the audio output in 3/4 dB steps, until that comparator becomes inactive. The second comparator is active all the time the first comparator is active. When the audio output peaks drop below the second comparator's reference, and remain below it for about a second, the Up/Down input of the 4029 is switched to DOWN and the 4093B slow counter is enabled and begins to increase the amplifier gain in 3/4 dB steps, at a relatively slow pace. Thus, the peak modulation is kept within less than one dB of maximum over a 12 dB range, but does NOT 'PUMP' if the peak levels remain relatively constant. (If the modulation peaks are at 95% at zero dB compression, they will also be 95% at over 10 dB of compression.)

The scope tracings in Figure 4 show the input and output of the DALC. The initial input level is approximately -45 dBm. At the end of the first two cycles, the level is instantly increased by 10 dB. The lower (output) trace shows how quickly the first negative peak is reduced as the amplifier gain is digitally changed. The next positive and negative peaks have minor gain adjustments that effectively center the waveform. At the end of a cycle and a half, the output level and waveform are stabilized at the level it

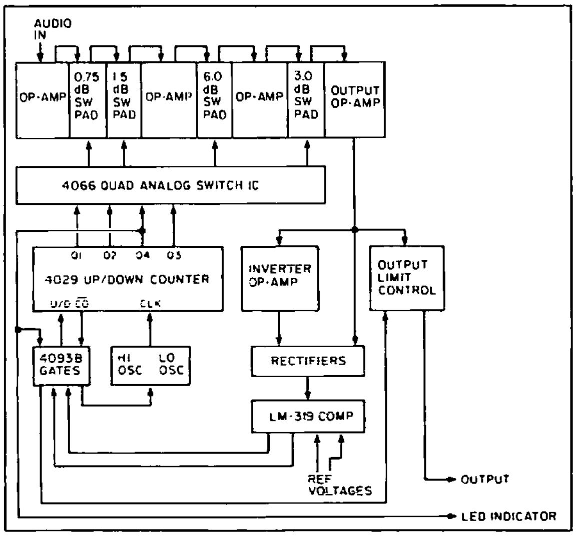


Figure 3. Block diagram of the Digital ALC.

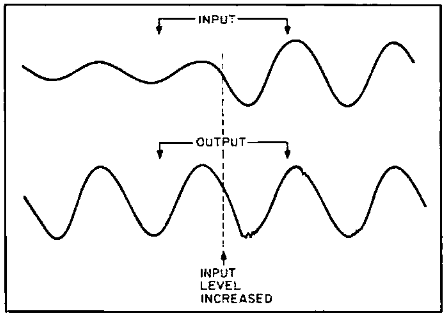


Figure 2. Scope tracings.

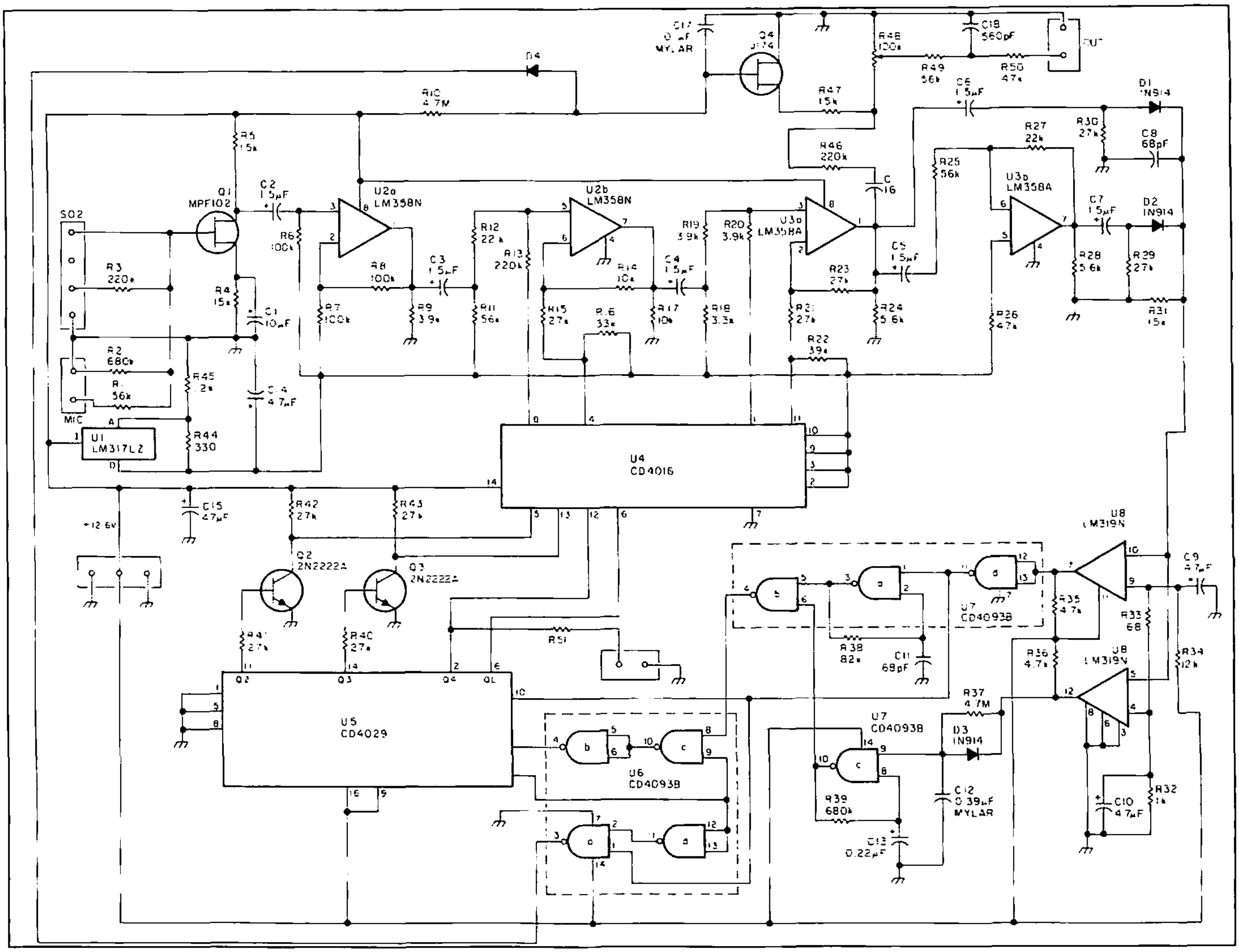


Figure 4. Schematic diagram of the digital ALC.

was before the input level increase.

The advantages of such a circuit include [a] precise incremental control of the maximum output (over a range of more than 3 to 1); [b] recovery that is at a consistent rate; and [c] maximum output level that remains constant over the compression range.

The diagram of a prototype of Figure 2 is shown in Figure 3. As it was intended as a microphone preamp that could be used with any transmitter, it uses an FET preamp feeding one half of an LM-358 dual op amp. If the output level of the microphone is excessive, a resistor may be installed in So(2) to reduce the input level to the appropriate amount. This is followed by two more sections of LM-358s that include a switched L-Pad in the input, plus a switched negative-feedback pad in each amplifier. The last LM-358 section is used as an inverter, to provide both positive and negative peak detection for the comparators.

The output of the third IC stage also passes through an RC audio filter, level reduction network and output level control before being applied to the transmitter MIC input. Included in this network, is an FET that automatically reduces the audio output by

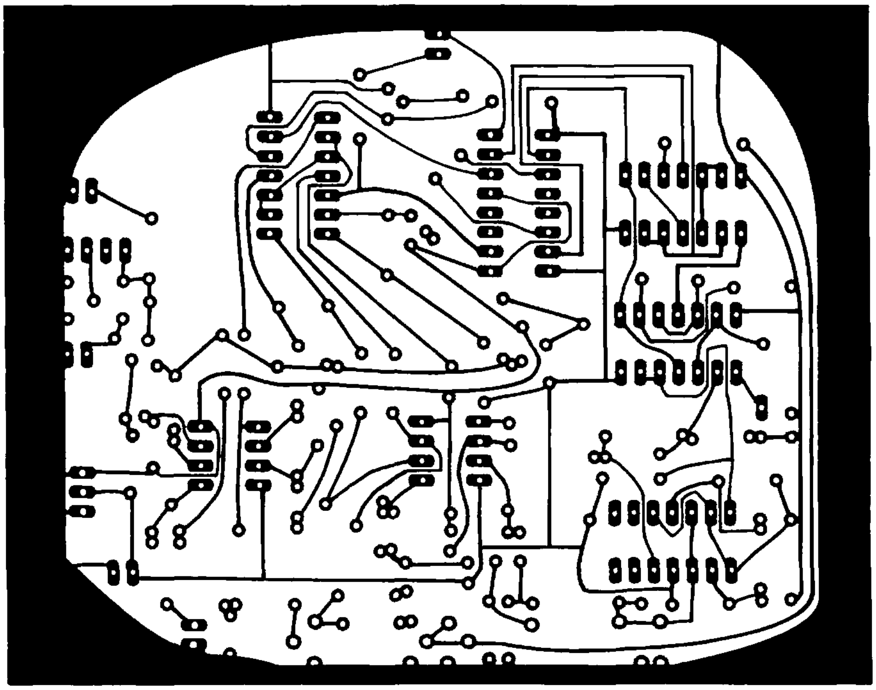


Figure 5a. PC board foil pattern.

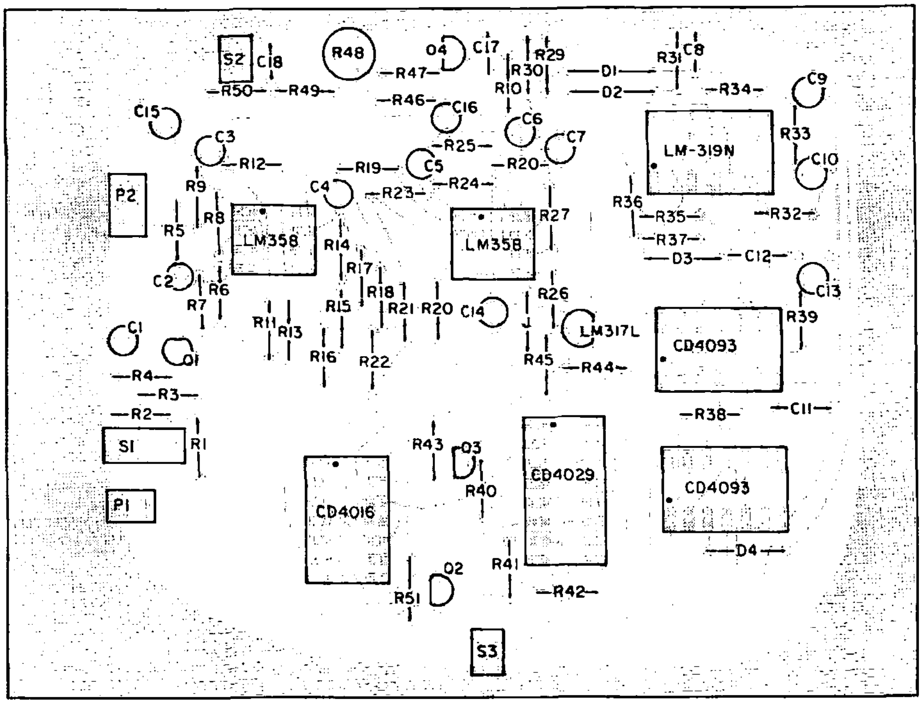


Figure 5b. PC board parts layout.

about 50% if the input from the microphone is driving the ALC circuit beyond its designed maximum of 12 dB of audio level compression. This FET is deactivated as soon as the audio peaks no longer exceed the compression range.

A jack is provided for an LED that will light at 6 dB of compression, and remain lighted at all higher compression levels. The microphone input level should be such that this LED flashes on occasionally, but not continually, while the transmitter is being modulated.

With both input and output levels easily adjusted, this unit will work well with almost any transmitter with medium to high impedance input.

This MIC level device is just an example of a practical application of digital ALC. For use within a transmitter under construction, the input FET, and output pad network could be eliminated—and the DALC inserted in the audio chain wherever the level is about 1V. Adding another counter and quad bilateral switch would permit the incremental peak output range to be any fraction of a dB, and/or the range could be extended to 15 or 20 dB.

Parts List

Resistors:		R43	27k
R1	56k	R44	330 ohms
R2	680k	R45	1.2k
R3	220k	R46	220k
R4	15k	R47	15k
R5	15k	R48	100k pot
R6	100k	R49	56k
R7	100k	R50	47k
R8	100k	**Capacitors:**	
R9	3.9k	C1	10 µF/25V Elect.
R10	4.7 MEG	C2	1.5 µF/25V Tant.
R11	56k	C3	1.5 µF/25V Tant.
R12	22k	C4	1.5 µF/25V Tant.
R13	220k	C5	1.5 µF/25V Tant.
R14	10k	C6	1.5 µF/25V Tant.
R15	27k	C7	1.5 µF/25V Tant.
R16	33k	C8	68 pF ceramic
R17	10k	C9	4.7 µF/25V Tant.
R18	3.3k	C10	4.7 µF/25V Tant.
R19	3.9k	C11	68 pF ceramic
R20	3.9k	C12	0.39 µF/Mylar
R21	27k	C13	0.22 µF Tant.
R22	39k	C14	4.7 µF/25V Tant.
R23	27k	C15	47 µF/25V Elect.
R24	5.6k	C16	2200 pF mica
R25	56k	C17	0.1 µF Mylar
R26	47k	C18	560 pF
R27	22k	Diodes:	
R28	5.6k	D1, D2 & D3	1N914 or equiv.
R29	27k	**FETs:**	
R30	27k	Q1	MPF-102
R31	15k	Q4	J174
R32	1k	**Transistors:**	
R33	68 ohms	Q2, Q3	2N2222A
R34	12k	**ICs:**	
R35	4.7k	1 ea.	LM-319N
R36	4.7k	2 ea.	LM358N
R37	4.7 MEG	1 ea.	CD4016 (or CD4066)
R38	82k	1 ea.	CD4029
R39	680k	2 ea.	CD4093B
R40	27k	1 ea.	LM317LZ
R41	27k		
R42	27k		

Number 9 on your Feedback card

73 Review

by Greg Saville N7IDB

AEA's Weather FAX Decoder

HF FAX on an IBM PC.

Advanced Electronic Applications, Inc.
P.O. Box C2160
2006 196th St. S.W.
Lynwood WA 98036
(206) 774-5554
Price Class: $150

The AEA-FAX™ is a multi-intensity gray-scale FAX receiving system that works with IBM or compatible computers. Those of you who are familiar with AEA's PK-232 multimode TNC already know that its FAX capability is limited in that it can only decode two levels of brightness. While this provides reasonable results for simple line drawings like weather charts, it leaves a lot to be desired for true gray-scale transmissions such as satellite images or newswire photographs. The AEA-FAX system can decode 16 levels of gray, which provides very nice reproduction of satellite photos transmitted by the NOAA weather services when viewed on a VGA video monitor.

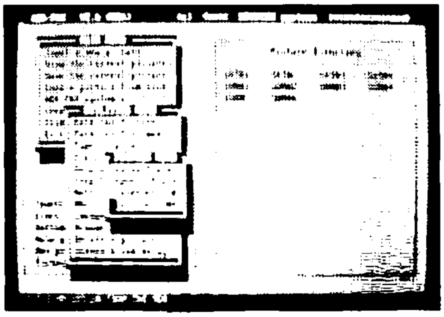


Photo A. AEA-FAX is menu-driven and mouse compatible for ease of use.

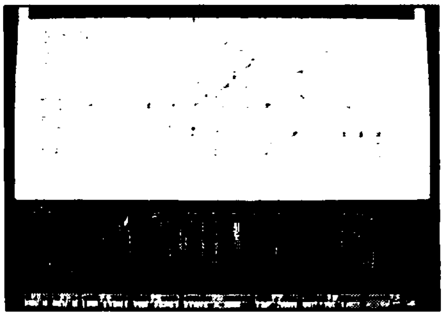


Photo B. Using the miniscope while capturing a weather FAX.

Photo C. Sample weather satellite image showing the high quality possible when viewing on a VGA screen.

What Do You Get?

The AEA-FAX system includes a FAX demodulator adapter, software on both 3-1/2" and 5-1/4" disks, and a 28-page owner's manual.

The FAX decoder modulator resembles a large serial connector with male and female 25-pin RS-232 D connectors. One connector plugs in to one of your serial ports while the other side can accept another serial device (like a PK-232 or modem, but not a mouse) so both can share the port. When you're not using the AEA-FAX, your computer can still use the other serial device so you don't have to keep plugging and unplugging cables when you want to use the port for something else. The demodulator adapter has a 5' shielded audio cable with a standard 1/8" phone plug that connects to your receiver's remote speaker jack to provide the FAX input.

AEA thoughtfully includes their software on both sizes of disks, so you don't have to worry about being sure of getting the right version for your system and they don't have to worry about stocking two different versions.

The owner's manual is very well written and quite complete. It begins with a one-page "Quick Start Procedure" section for those of us who are most anxious to get up and running immediately. More details follow, including "Hardware Requirements," "System Overview," "Functions of the Components," "Installation of the Hardware and Software," "Running the Program," and "Capturing Live Data," plus a technical discussion of how facsimile transmissions work and more details of how to use the various software modes, with command summaries. Lastly, some weather FAX frequencies are listed, along with a short discussion of radio propagation considerations, a glossary, and illustrations of the system layout and examples of the various received waveforms as shown by the Miniscope function.

Quick Start Procedure

Installation and setup was very brief and easy, thanks to the Quick Start Procedure. I just plugged the device into my COM1 port, plugged the audio cable into my TS-440, mounted the floppy disk in my system and typed: INSTALL. The install program creates an AEA-FAX directory on your hard disk and copies all the software to it. I started the program by typing: FAX, and then tuned in a FAX transmission. In just a few seconds a weather chart started to appear on my screen! While waiting for the image to complete, I read some more of the manual. As more of the picture appeared, I noticed that the image was somewhat slanted, but found instructions to adjust the timing to my system to provide perfectly aligned images. I found the program very easy to use: Windows and menus are provided for all functions, help screens are available and all selections can be made with arrow keys or a mouse.

You can find your way around and do just about everything without even needing the manual.

View Mode

Once a complete image is received, you can save it to disk for later viewing. To load a saved FAX, just select the "Load a Picture from Disk" menu item with the mouse or arrow keys. A directory listing of available pictures is displayed and you just click on the one you want. Next, you select "View the Current Picture" from the menu and the FAX is displayed. Several viewing options are available in view mode, including moving the picture left or right, scrolling up or down to see pictures larger than your display, mirror, flip, invert, zoom, print, color palette selection or edit, and a help function. Pictures can even be exported to .PCX Paintbrush file format for further editing or touch-up with PC Paint.

Input Mode

Capturing pictures couldn't be easier; the software automatically detects start and sync tones and adjusts itself for different FAX formats. It even automatically adjusts the gray-scale level decoding to the signal to ensure full gray-scale representation.

While in input mode, there are several commands you can enter including toggle invert, toggle reverse, lines per minute select, index of cooperation select, automatic mode, screen clear, resync screen, miniscope select and a help screen.

Miniscope

Proper tuning of your receiver to the FAX signal is vital for good results and AEA provides a handy way to adjust your receiver with the built-in Miniscope. Anytime you're receiving a FAX, you can select the Miniscope by pressing the "M" key. The screen splits and shows a spectrum analysis of the FAX signal in the lower window of the screen. In real time, you can watch the effect of tuning and volume

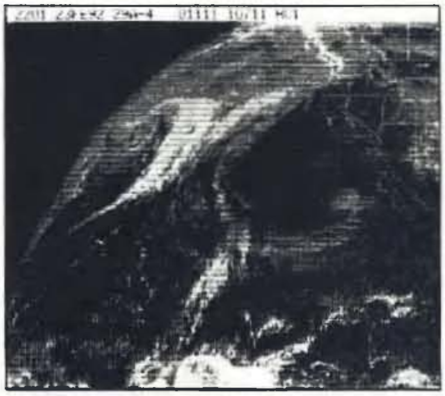


Figure 1. Sample hard copy output of a weather satellite image as printed by AEA-FAX on a laser printer.

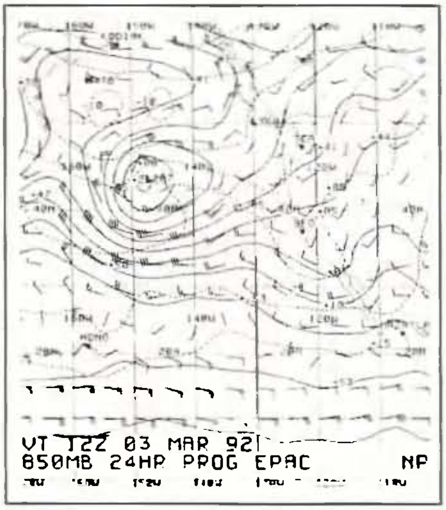


Figure 2. Sample hard copy of a typical weather chart as printed by AEA-FAX on a laser printer.

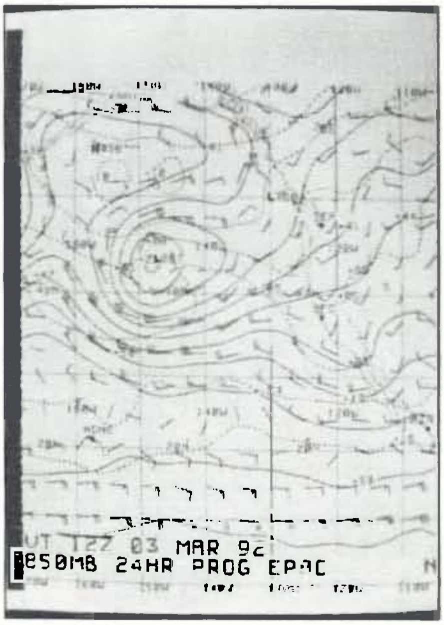


Photo D. A sample weather chart produced by the AEA-FAX.

level adjustments and select the settings that give you the best quality picture. I like the miniscope so well that I almost always leave it on.

Advanced Features

Watching an image slowly appear line by line is

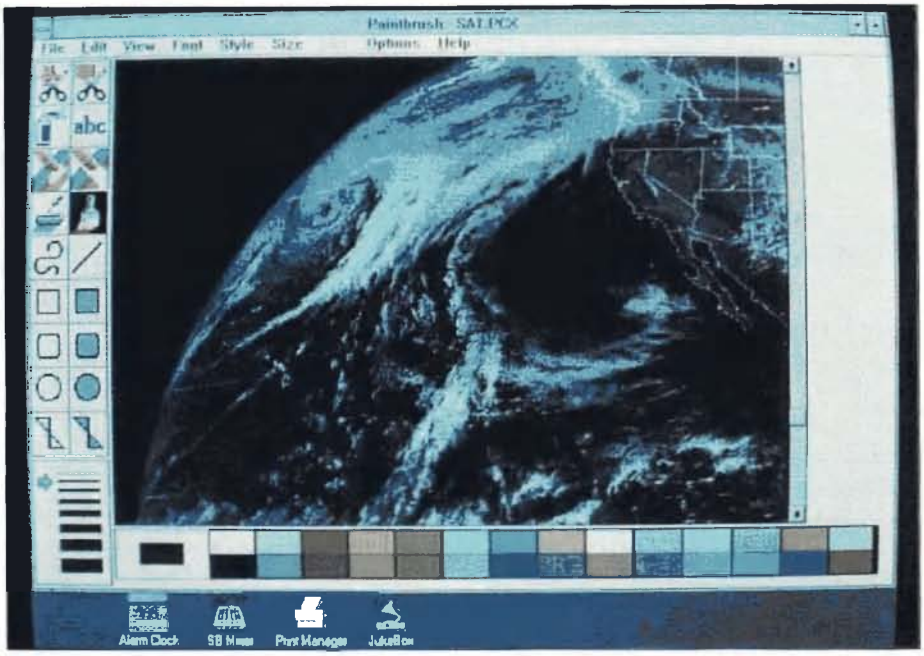


Photo E. AEA-FAX includes an image export utility that converts images to standard ".PCX" PC-Paintbrush format for editing and touch-up.

fun the first few times, but since it can take 10 to 15 minutes for a complete transmission, it becomes less exciting with time. This is where the unattended capture or "Autolist" feature is appreciated. The Autolist function allows you to capture pictures automatically while you're away from the system for viewing at a later time. Options allow you to program a specific timetable to collect just the images you want, as long as you know the schedule of the station you're listening to.

Entering a special time of 99:99 sets the Autolist feature to decode and save every FAX transmitted. This turns out to be my favorite mode.

Images can be printed on Epson 9- or 24-pin dot matrix printers or on Hewlett Packard compatible laser printers in 150 or 300 dots per inch resolution. I found that text or line drawings, like most weather charts, printed nicely, but multi-level grayscale photographs obviously can't be printed as well on a device that only has two color choices—black or white. In its best mode, the program dithers the image to provide nine gray levels at the expense of some resolution loss. While the printed images can't approach the quality of the on-screen views, they sure were a hit in my son's elementary school class when they were studying a unit on weather.

A neat slide show utility is provided, which is a great way to show off your best images. This mode allows you the ability to display a series of cloud-cover pictures like they do on the 11p.m. TV news.

The utilities menu offers a number of file handling and capture functions including setting up a default directory for file operations, printer selection and options, start and stop tone threshold, stop tone frequency, auto sync delay, display shades, menu screen colors, and even adjustment for a built-in screen saver mode.

Suggestions

While I'm really impressed and satisfied with the unit, there always seems to be something minor that can be improved. I'd like to see an easier way to start the autolist unattended capture function. As it is now, you need to select the autolist menu option and type in several parameters, exit, and then start autolist with ALT-L. I'd like to see a simpler setup where you just select a menu item that starts decoding and saving all files right away with some default, yet unique file names. It would also be nice if there was a way to load and view a file in one step, like maybe double clicking on the file name. As it is now, you first select the load function, select the file you want to load, then select the view function. This gets tedious if you have 30 or so new files you'd like to quickly scan through.

Being the tinkerer that most hams are, I'd also like to see a schematic diagram for the demodulator circuit. It's a pretty simple, yet clever, circuit that taps its voltage from the RS-232 control lines and does an amazing job of decoding analog levels through a serial port!

One other minor suggestion has to do with the product packaging. The box contains a little compartment for the disks and I noticed that my 3-1/2" disk fits pretty snugly, enough so that the floppy disk case is now permanently distorted. Not enough to prevent the disk from spinning, but it doesn't look like it would take much more to cause trouble. I've decided not to snap the disk back into its compartment for storage.

Lastly, I think a nice follow-on product would be another program or software upgrade to use the demodulator circuit to decode and display SSTV pictures. It seems the hardware is capable; it would just take some additional software to display it properly.

Do I Like It?

I have thoroughly enjoyed playing with the AEA-FAX system and especially like seeing the ever-changing cloud patterns from the satellite photos. The software is quite good, easy to use, and hasn't exhibited any bugs. For the enjoyment value alone, I feel quite satisfied. For someone who really needs access to the various weather information available, the cost is very reasonable. 73

73 Review

by David Cassidy N1GPH

The Larsen KG 2/70 Glass-Mounted Antenna

Larsen Antennas
P.O. 1799
Vancouver WA 98668
Telephone: (206) 944-7551;
(800) 426-1656
Price Class: $85

Until very recently, I have always driven what could be kindly referred to as "klunkers." While all of my friends were taking out huge loans to get the latest and greatest offering from Detroit or Tokyo, I was stuck with whatever the used car salesman thought he could dump on me.

For a ham, there *is* one advantage to driving an old, beat-up car: You never have to worry about attaching any kind of antenna to it. Since there is no way to harm a car that is already overdue for the junkyard, you can drill, attach, fasten, hang and install to your heart's content.

All of this changed for me when I finally bought my first never-before-driven, "0" on the odometer, brand-new car. It's a little red coupe, and the last thing I wanted to do was slap a mag-mount on that shiny paint, or stick some aerial monstrosity on the trunk lip. Since I wanted to operate both 2 meters and 440 MHz, I needed a dual-band antenna. Also, since I live in a very hilly area of the world, I wanted a bit more signal punch than your average quarter wave. Of course, the answer to a new-car owner's prayers is a through-the-glass antenna, but a few calls to the various mail order companies soon confirmed my worst fears: Nobody makes a dual-band, glass-mounted antenna. I swallowed my pride, opened my wallet and was soon dragging along a very nice, but very ugly, dual-band antenna—complete with what looked like a military-issue trunk lip mount (actually, it was a high-quality piece of hardware from a very well-known company, but the high loan payments for the new car had clouded my judgement).

Not long after I broke down and installed the trunk-mounted antenna, Larsen started advertising their new KG 2/70 dual-band, glass-mounted antenna. A few phone calls and one more trip to my wallet for the credit card later, I was the proud owner of a dual-band, glass-mounted antenna.

The KG 2/70

The KG 2/70 is a sleek-looking, unobtrusive antenna. With its black polyurethane coating and the exposed coil-in-the-whip design, it looks like a cellular phone antenna on steroids!

Electrically, the KG 2/70 is a half wave on 2 meters and a collinear on 70 centimeters. No ground plane is needed (go look it up, if you want to know why), and Larsen claims gain of 2.5 dBd on 2 meters and 4.5 dBd on 70 centimeters.

The antenna is pre-tuned to provide a 1.5:1 SWR. Minor adjustment is provided by moving the whip up or down about 1/2 inch and securing it with a setscrew. I found that this adjustment had minimal effect on the SWR, so I left it as it came from the factory—fully inserted.

Installing the KG 2/70

Installing the KG 2/70 takes all of about 10 minutes. Everything you need is included, and the step-by-step instructions are quite clear.

The only trick to installing any glass-mounted antenna is making sure the glass is at room temperature. (Since I ordered the antenna around Thanksgiving and I don't have a garage, I waited until April!) The only other precaution is to make sure your window is clean, both inside and out. Ignore either of these precautions and you may find yourself dragging your antenna down the highway someday.

After deciding where you want to mount the antenna (usually the upper edge of the back window), all you do is clean the glass, swab the surface with the supplied alcohol pad (to get the glass *really* clean), measure and mark with a pen (so you get it right where you want it), apply the supplied adhesive, peel off the backing on the mounting plates (one for the inside and one for the outside), and press. I would suggest that you peel off the backing paper from the mounting plates *before* applying the liquid adhesive to the window. This stuff dries very quickly, and you don't want to be fumbling with the backing paper while it does.

Once you have the plates stuck to the inside and outside of your window, the only thing left to do is run the coax (a few press-on coax clips are supplied to help route the coax along the top of your window), solder on the supplied PL-259 and attach it to your rig. Your initial thought upon seeing the supplied but unsoldered PL-259 may be, "Those lazy @#+%&s! Couldn't they have installed the lousy plug!" After a few moments, you'll also realize how much easier it is to route the coax through your vehicle *without* that bulky connector hanging up on everything. Wait until you're done routing the coax to the rig, *then* solder on the PL-259. It will save you time and skinned knuckles.

On The Road

Photo A. the Larsen KG 2/70 mounts directly on glass.

The true test of any antenna is how it works in real-world conditions (I probably wouldn't feel this way if I had an antenna test range, but I don't't). I set up an A-B test between the KG 2/70 and the top-quality dual-band antenna I had been using.

The KG 2/70 turned in almost identical performance to my other dual-band antenna. When you consider that the antenna isn't *physically* connected to the radio, this is pretty amazing. In fact, the KG 2/70 was a little better on transmit. This was probably due to the fact that the KG 2/70 was mounted at the very top of my rear window, while my other antenna was attached with a trunk lip mount, placing a major portion of the antenna element below the roof line.

On the receive side of the coin, I didn't notice any difference at all, but in another A-B test between the KG 2/70 and a 2 meter 5/8-wave mag-mount, the KG 2/70 provided a noticeable increase in the receive range (about two S-units).

Conclusion

I am quite pleased with the performance of my KG 2/70. If you were ever disappointed by earlier experiences with capacitively-coupled, glass-mounted antennas, you should give this new antenna a try. I have to admit that I was never impressed with the performance of glass-mounted antennas. Sure, they worked OK, but they were a compromise between aesthetics and performance. The KG 2/70 lets me have my cake and eat it too!

. . . and it looks cool on my little red car! 73

A Frequency Counter Upgrade

Accuracy at the flip of a switch.

by James Flynn KD9ZT

Many hams have a frequency counter as part of their station, or for use as a test instrument. If you're in this group, I'm sure you wonder how accurate your counter is. Frequency is often a point of argument among amateurs, and discrepancies exist. In this article, I'll explain an inexpensive modification, adaptable to almost any counter, that I used to make a highly accurate and stable instrument.

Frequency Counters

A short review of frequency counter operation will show the cause of inaccurate displays. "Timebase" refers to the length of time (usually 1 or 0.1 second) that an electronic "gate" allows for the unknown input signal to reach the counters. While this gate is open, the cycles of the unknown signal are counted. When the gate closes, the count is displayed on the front panel, circuitry is reset, and the gate re-opens for a new count. Obviously, if the gate remains open for too long or too short a time, the counter will err high or low, respectively.

If the unknown signal happens to be 146 MHz, for example, a gate-timing error of only one-millionth of a second would produce a count error of 146 Hz. To achieve such precision may seem unthinkable, but frequency division makes it possible. Most counter timebases are generated by dividing the frequency of a crystal oscillator running at several MHz down to 1 Hz. As the frequency is divided, so is the frequency error. The oscillator may be off several kHz, but after division by several million, the error becomes minute. Still, extreme precision is essential, and crystal oscillators are prone to drift with time and temperature, leaving timebase accuracy in question.

My counter is an inexpensive Heathkit IM-2410, purchased for tune-ups, tinkering, and repair work. I soon realized that warm-up drift of the unit was substantial, amounting to 500 Hz on the 2 meter band over a two-hour period. I was dissatisfied with such dubious accuracy, and began pondering ways to modify the timebase oscillator for better stability. A crystal oven or a substitute timebase frequency source seemed logical choices.

Selecting Your Standard

Probably the most stable oscillator available to an amateur is a surplus frequency standard, a proportionately controlled, oven-sized, crystal oscillator. Companies such as CTS Knights produced these units for the US military. They are generally available at hamfests, and I have seen them in a surplus house catalog. I obtained a Knights standard, and began the project of adapting it to my counter as a substitute timebase oscillator.

The Knights frequency standard is housed in a plated brass can 2" x 2" x 5" long. All connections are made at the bottom through an octal plug/socket. Removing a threaded plug from the top of the can exposes a piston trimmer capacitor, used for precise frequency adjustment. This unit has a frequency output of 1 MHz at approximately 4 volts rms. Once temperature and frequency stability are achieved, drift is specified as no more than one part in 10^8 per day. Actual drift will likely be much less. It requires 28 volts DC at approximately 0.2 amps. Cold start-up current may reach 0.5 amps due to high demand by the heating element. Standards made by other manufacturers may have different outputs and power requirements.

The Heath IM-2410 timebase frequency is generated by an adjustable 3.579 MHz crystal oscillator/divider, V10 (Figure 1). V10 output frequency is 60 Hz. Driver transistor Q6 provides a suitable waveform to U8, a divide-by-six with 10 Hz output. These 1 and 10 Hz frequencies are routed from a front panel switch to the signal input gate circuitry to allow selection of a 1 or 0.1 second gate.

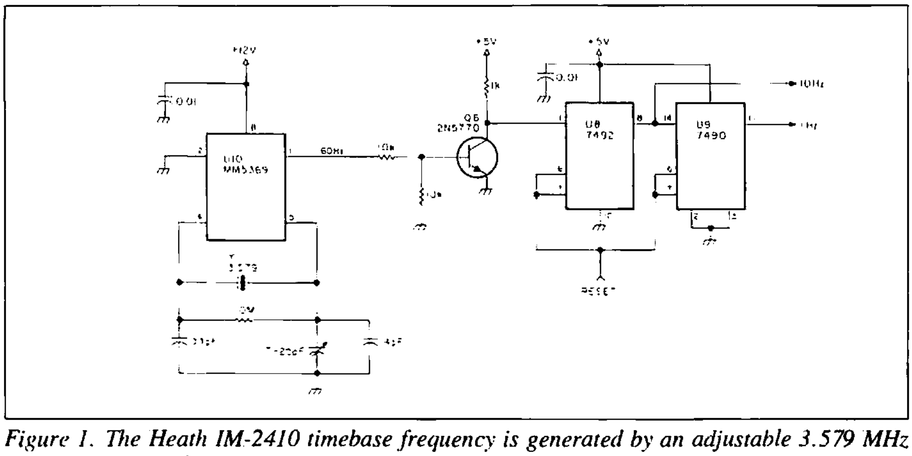


Figure 1. The Heath IM-2410 timebase frequency is generated by an adjustable 3.579 MHz crystal oscillator/divider, U10.

Designing the Modification

It's apparent from the Heath circuit that 10

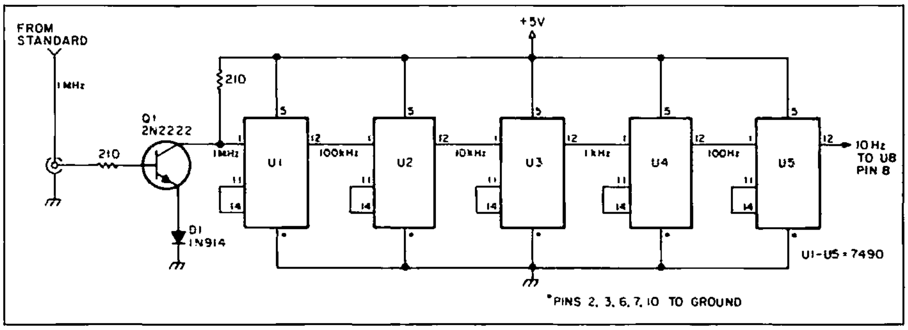


Figure 2. To build this curcuit, you only need five 7490 decade counter/dividers and a piece of perfboard.

Hz would be an ideal substitute frequency to inject into the timebase generator. With 1 MHz available from the Knights standard, I needed only to divide by 100,000, or equivalently, to divide by 10 five times. I bought five 7490 decade counter/dividers and a piece of perfboard to construct the circuit in Figure 2. The chips are wired in series divide-by-ten. The Q1 transistor stage was necessary to shape the sinusoidal output of the frequency standard into a shape resembling a square wave, with the steep edges necessary to reliably trigger the first divider.

Diode D1 accomplishes this task by holding the transistor in cutoff until the 4 volt sine wave applied to the gate reaches about +1.4 volts. This is the combined voltage drop of D1 and Q1 base-emitter junction. At this point the transistor turns on sharply, giving a steep leading edge to its output waveform. The reverse occurs on the falling edge of the sine wave. A second diode in series with D1 would "square" the output waveform even more, but it was unnecessary in this case. Note that the input waveform must be of ample voltage to overcome the voltage drops of Q1 and any emitter diodes. Had the output of the frequency standard been insufficient, a preamp stage ahead of Q1 would have been necessary to boost voltage.

The next task was to mount the perfboard inside the Heath cabinet. Finding no likely place for nut-and-bolt mounting, I soldered two #16 wire "legs" to the perfboard, positioned to match areas of ground foil on the Heath board. I soldered the legs to the ground foil, supporting my assembly above the main counter circuitry. This type of mounting appears entirely adequate for small structures. I took +5 volts directly from the Heath regulated bus. Interfacing to the IM-2410 was simple—I removed U8 from its socket and plugged the substitute frequency from my divider into the pin-8 (output) position of the U8 socket.

Next, I mounted the frequency standard onto a 5″ x 6″ x ⅜″ board, which left adequate room for a companion 28-volt power supply. I used a Radio Shack miniature 24-volt transformer. The rectified, filtered DC output is about 34 volts. A simple Zener diode-controlled pass transistor lowers voltage to the 28 volt requirement. Power supply circuit descriptions are readily available from many sources, so I will not go into detail. Good supply regulation is not necessary, as the Knights standard has precise voltage regulation internally for critical circuitry. A 24-volt wall transformer would likely suffice, although I haven't tried one.

I mounted this assembly on top of the counter with ¼″ standoffs to avoid blocking ventilation holes. The 1 MHz input frequency is fed to the divider inside with RG-174 mini-coax, through a ⅛″ phone jack installed in the cabinet rear panel. You could also place the standard apart from the counter and use a longer feed cable. To avoid an additional 115 volt supply cord at my station, I wired the power supply transformer primary through a strain relief in the counter's rear panel to 115 volts points inside, so that the Heath line fuse also protects the transformer. The 28-volt supply and the frequency standard are always powered, unaffected by the counter on-off switch. Reassembling the cabinet completed installation, and a quick check confirmed that the counter was operating normally.

Calibrating the Standard

Calibration of the frequency standard is quite easy. Install a coaxial "T" fitting in the feedline of one of your HF antennas at your operating position. Tune your SSB rig to WWV at 10 MHz, then move up a few hundred Hz to hear a tone from their carrier. A sharp CW filter helps give a cleaner tone, reducing modulation effects. Feed a sample of the 1 MHz frequency standard output through a 100 pF capacitor to the coax "T." The tenth harmonic of the 1 MHz frequency will beat noticeably with the WWV carrier. Use a miniature screwdriver to adjust the output frequency of the standard.

As this frequency nears zero beat, the S-meter will deflect 2–4 units with each beat, and beats will be audible in headphones or speaker. It helps to calibrate the standard during periods when QSB on WWV is at a minimum. With a little practice, one beat every other second can be achieved. More accurate calibration becomes difficult due to confusion with QSB, but it is by no means necessary. A beat every two seconds is equivalent to ½ Hz error at 10 MHz. This extrapolates to a 7 Hz error on the 2-meter band, and to a 23 Hz error at 450 Mhz. Few counters can approach this accuracy.

Maintaining Accuracy

With this particular standard, I've noticed that a "stabilization" period is necessary each time the frequency trimmer is moved. I don't know if this is typical. I usually wait several hours to check the results of each adjustment. But once calibrated, months go by without frequency checks. It just isn't necessary. The frequency standard runs along most dependably. My counter never leaves the shelf, but one that is subjected to rough use would probably require periodic frequency checks to maintain the accuracy stated above.

This may be my most worthwhile home-brew project to date. It is very enjoyable to have accurate frequency measurement capability at the flip of a switch—without warm-up, without drift. If you have the frequency counter "doldrums," investigate adapting this procedure to your counter.

W9ZTK deserves credit for the technical specs of the Knights frequency standard, as well as my thanks for his help in making this project a reality.

A limited supply of 10 MHz frequency standards (EG&G model T-424, 12 VDC) are available for $16 ppd. from Chuck Houghton WB6IGP, 6345 Badger Lake, San Diego, CA 92119. To use these modules with the circuit in Figure 2 you will have to add on an additional 7490 decade divider. 73

You may reach James Flynn KD9ZT at Box 32, Dana IL 61321.

ATV

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Video Ins and Outs

If you have a computer in your shack, you've probably thought about using it to capture and display a still-frame image of your ATV contacts. Once you have that special image in your computer, you could label the image with the time and date of reception and actually start a video logbook! Not only that, you could snap a still-frame of yourself, label it with your callsign using any of several drawing programs, and use this for your video ID. Getting that priceless video image into your computer is of particular interest to those of you who are using a computer for slow-scan TV (SSTV).

Up until recently, the only way you could snatch a video image into your computer was through the use of very expensive digitizers. Fortunately, there are a number of fairly inexpensive boards and interfaces now available that won't cost more than your computer! There are quite a few to choose from, and this is not a list of all that is available by any means. However, I'd like to discuss a few of the inexpensive boards I've run across that I think will be of particular interest to ATVers and SSTVers.

Black and White Digitizers

The least expensive boards are those that will do only black and white images. Depending on your needs, these boards are certainly the most affordable way to digitize your video image into your computer.

The SV1000 Video Digitizer

For just $89.98 + $5 shipping, you can obtain a small board that plugs into your computer's parallel port. It comes without a case and requires you to strap a 9-volt battery onto the board for power (you can leave the battery attached since it is only used for power during the brief period of time a capture is being performed). A BASIC program is included in the package that allows you to capture a black and white video image in anywhere from 10 to 20 seconds, depending on the resolution you require. The digitizer provides either 640 by 480 or 320 by 200 resolution and will operate with any IBM PC or compatible from an 8088 to a 80386 with a CGA, EGA or VGA display. The program allows you to vary contrast, brightness and sync via software control to oblain the best image. The image is digitized in 256 shades of gray, which results in a very high quality image. The SV1000 and its companion program are available from Frank Lyman at Colorburst, P.O. Box 3091, Nashua NH 03061; phone: (603) 891-1588.

The Ventek VIP 640M

Coming in at $129, the Ventek VIP 640M is a black-and-white digitizer that plugs into an internal slot in your XT computer (the VIP 640M/AT, priced at $149, is for use in an AT machine). These digitizers take about 1/3 of a second (1/5 second for the AT version)to capture the image (operating as a line grabber) and digitize the image with 256 shades of gray with a resolution of 680 by 480 pixels. A PAL version is also available.

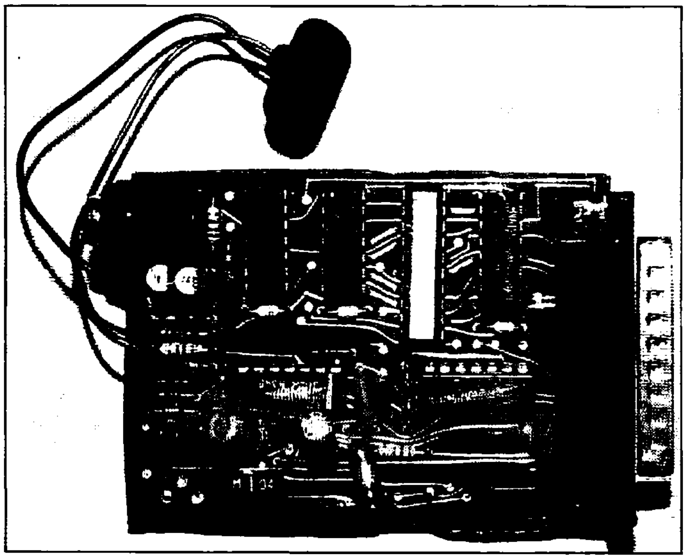


Photo A. The SV-1000 monochrome video digitizer from Colorburst.

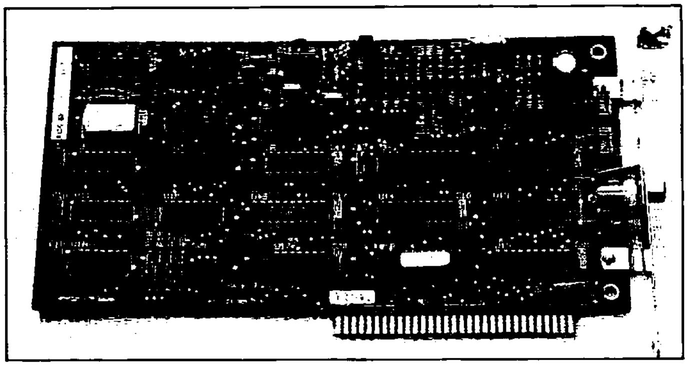


Photo B. The Ventek VIP 640M monochrome video digitizer.

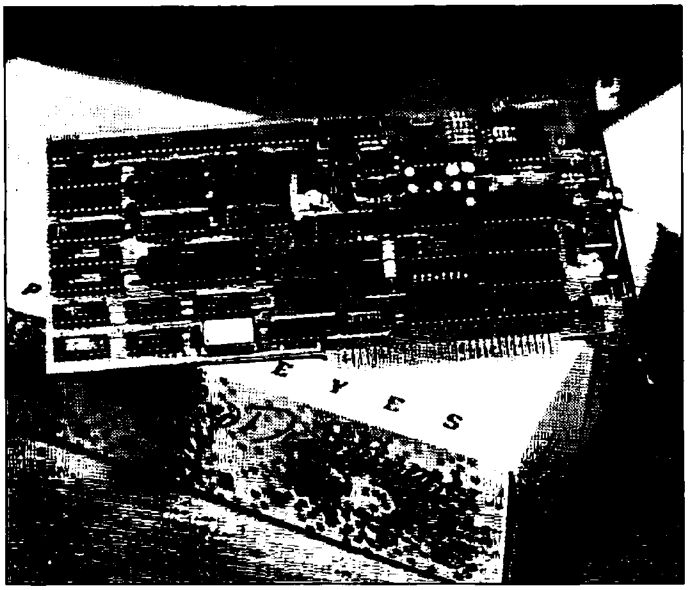


Photo C. The ComputerEyes R/T color frame grabber board from Digital Vision, Inc.

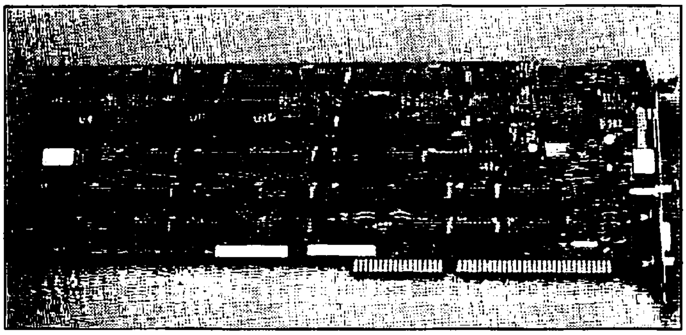


Photo D. The Ventek VIP 640C color video digitizer.

The VIP 640M comes with some very powerful software that allows you to get the most out of the digitizer and to store the image in all popular file formats. You also get a program called "Picture Publisher" that allows you to modify, edit and manipulate the image. For more information, contact Teri Csellak or Mark Montana at Ventek Corporation, 31336 Via Colinas, Suite 102, Westlake Village CA 91362; phone: (818) 991-3868 or FAX: (818) 991-4097.

ComputerEyes B/W

Digital Vision, Inc. offers a monochrome board that will digitize an NTSC or PAL video image for $249.95 that plugs internally into your PC. It captures a 640 by 480 pixel image with 64 gray levels. It takes from six to 12 seconds to complete a capture and will support Hercules, CGA, EGA, VGA and Super VGA displays. Its companion software allows you to display the image in a variety of modes: high contrast, gray scale, dithered grays and false color. In addition, extensive enhancement routines allow you to adjust brightness and contrast, and to sharpen, smooth and halftone the image. All popular image file formats are supported. For more information, contact: Digital Vision, Inc., 270 Bridge Street, Dedham MA 02026; phone: (617) 329-5400.

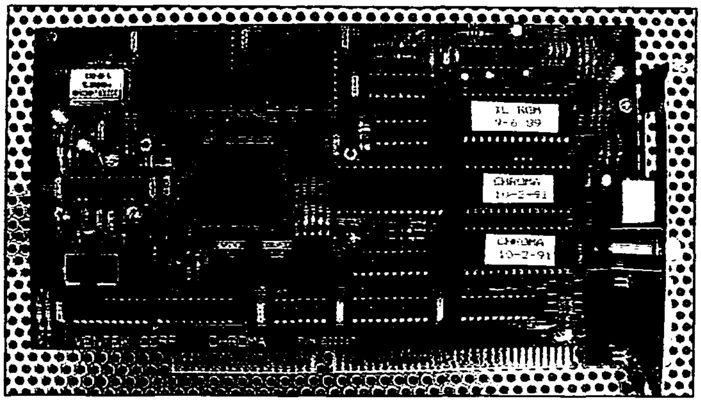


Photo E. The Ventek CHROMA VGA display board capable of 32,768 colors (Hi-Color mode) comes with an NTSC video output.

Color Video Digitizers

If you want the ultimate in video digitizers, particularly if you already own a VGA display, you might as well go for a full-color digitizer. Although more expensive, I think you'll find the results to be impressive enough to make the extra expenditure very worthwhile.

The Ventek VIP 640C

At $299, this is one of the most reasonably priced color digitizers (a PAL version is also available, model # 640 CP/AT.) You get a high-quality system that plugs inside your computer which is capable of capturing a 640 by 480 pixel image with over 16 million colors and 256 gray levels. It does this in less than a second. You can capture the image in either a 24-bit/pixel or 8-bit/pixel color mode, or even as an 8-bit/pixel monochrome mode depending on your needs. As with the VIP 640M monochrome board, you get a powerful software package that allows you to correct color, mask, cut, spray, or enhance the image as well as to create a collage effect with several images. In addition, you can use their FOTOfiler image database management software to store your image in an image database that is fully dBASE file compatible and allows easy retrieval and display of the stored images (perfect for an ATV logbook).

ComputerEyes/Pro

Priced at $399.95, this is the color version of the Digital Vision, Inc. ComputerEyes B/W board. It is capable of capturing a 24-bit (16 million colors) image and allows you to reduce the image to an 8-bit, 256 color mode on-the-fly. It takes from 1.5 to 24 seconds to digitize an image. It supports all common image file formats and an optional developer's package is available for incorporating scanning routines within an application.

ComputersEyes/RT

All of the previous digitizers we've discussed so far were only capable of digitizing an image if the subject holds still for anywhere between 1/5 of a second to as much as 24 seconds. This is OK if you have a good still-frame mode on your VCR, but the ultimate is to have a *frame-grabber* video digitizer. This allows you to capture just a single frame of video (1/30th of a second) in real time. Unfortunately, this kind of capability increases the price of the digitizer to the point where it is almost as expensive as the computer! Still, for those who want to snatch some live-action video, you might want to investigate the ComputerEyes/RT, priced at $599.95. This board allows you to frame-grab the image in a resolution of 512 by 512 pixels with a full 24-bits (16 million colors).

VGA to NTSC

One of the most frustrating problems among ATVers who own a computer is the inability to accurately show off their latest computer graphics and programs. The video format of most computers is NOT NTSC compatible (scan rates can be radically different) and can not be transmitted directly over the air. The only solution is to point your TV camera at your computer monitor and hope for the best. You get reasonable results by doing this, but some output formats cause an annoying flicker due to the scan rate differences, and the colors never come out quite the same. Wouldn't it be great to have a video-out jack on the back of your computer that you could just plug directly into your ATV transmitter?

Well, up until recently, that feature entailed an expensive card that would cost in excess of $500. Now there are some alternatives that are cost effective.

The Ventek CHROMA Display Board

For those of you wishing to upgrade your system to a VGA display, and particularly one with the new Hi-Color mode capable of 32,768 colors, you might want to investigate the new Ventek CHROMA HiColor VGA display board. This unique VGA board has an NTSC output built right in and comes in at a very economical $369. For more information contact: Ventek Corporation, 31336 Via Colinas, Suite 102, Westlake Village CA 91362; phone: (818) 991-3868 or FAX: (818) 991-4097.

Photo F. The TelevEyes module by Digital Vision, Inc. allows you to convert your existing VGA display into NTSC video.

The TelevEyes Converter

Priced at $299.95, this is a separate module from Digital Vision, Inc. that hooks inline between your computer and your monitor. This converter gives you an NTSC video output using your existing VGA display. For more information contact Digital Vision, Inc. at 270 Bridge St., Dedham MA 02026; phone: (617) 329-5400 or FAX: (617) 329-6286.

Digital Views

This is just a sample of some of the more economical systems that may be useful for the ATVer. Now that getting the video in and out of the computer is much easier, I expect that it won't be too long before we see some interesting new hardware and software that will allow you to process video in real time.

Look for some affordable special effects and image processing applications for your home computer that will rival that of commercial television in the near future. 73

HOMING IN

Number 13 on your Feedback card

Radio Direction Finding

Joe Moell, P.E., K0OV
P.O. Box 2508
Fullerton CA 92633

T-Hunt Trickery

Jammer tracking, noise location, search and rescue—there are many reasons why hams get into radio direction finding (RDF). But no matter what your purpose, you'll find it takes experience in the field to become proficient with your equipment. Fortunately, practicing is lots of fun when you get together with fellow RDFers to hold hidden transmitter hunts, usually called T-hunts or foxhunts.

Hams sometimes ask, "What's so tough about T-hunting? You just take a bearing, plot it, and follow it to the T. No problem!" Either these people haven't done much hunting, or they're incredibly lucky, or they have never gone up against a worldclass hider.

Even in the simplest hunts, one or more teams usually become completely baffled at some point. And when the goal is to bamboozle everyone, there is no end to the stunts an imaginative huntmaster can employ.

Dirty Tricks 101

Most "Homing In" columns provide tips for the hunters. To even the score, it's time to help hiders prolong the suspense and the fun. But don't let the title fool you—you don't have to do anything illegal or unsafe to put on a tough hunt. Just use your ingenuity.

When a T-hunt is a real challenge, everyone benefits. The hider gets the satisfaction of knowing that the winners are working for their reward. The hunters gain valuable experience that may be useful on an RDF search/rescue effort, when lives are at stake.

Most RDFers I know would rather be foxhunting than doing any other ham activity. So the longer the hunt lasts, the more fun they have that day!

Devious hiding tricks fall into four basic categories:

1. Deceptive signal parameters
2. Inaccessibility
3. Indirect signal paths
4. Concealment and camouflage

We'll limit the discussion to category #1 this month, and confine it to single-transmitter VHF events where the hunters are mobile.

Typical rules for beginners' hunts call for the fox to transmit a continuous carrier with constant power and antenna polarization. If the hunt is held on a repeater input, the hider may transmit for 15 seconds, then be off for a minute or so.

To advance to a higher degree of difficulty, try sending very short bursts of signal (if permitted). WA6FAT turned an easy hunt into tricky one on a rainy night when he put the T in a replica of a medieval tower, transmitting for a fraction of a second every few seconds.

If hunt rules allow it, vary the hidden transmitter power. This is particularly hard on hunters using a beam, attenuator, and S-meter to get bearings, because that method relies on constant signal level for its accuracy. On the other hand, variable signal strength will not affect doppler or time-difference-of-arrival RDF sets, so long as the signal exceeds the set's minimum sensitivity threshold.

If you don't mind waiting a long time for the hunters to arrive, and are prepared to be the object of their outrage, combine short transmissions with varying power. This gimmick was used a few years ago at a convention hunt in San Diego, where expensive prizes were at stake. The hider, wanting to separate the skilled hunters from the lucky ones, set up the T to cycle on and off every half second, with each transmission at a different power level, randomly selected.

Not to be outdone, John Moore NJ7E built a microprocessor-based controller for an all-day hunt in the Phoenix area last fall. His fox-box generated random transmission lengths, random time between transmissions, and random power levels.

Antler Antics

If rules allow it, use creativity in your antenna system. Horizontal signal polarization is tough on hunters with dopplers or other sets with vertical whips. When you hunt a cross-polarized T, the direct signal is attenuated, while bounces from buildings and terrain features tend to stand out. With any luck, the contestants will spend valuable time chasing reflections.

Every so often, a fox uses circular polarization. Depending on the terrain, it can confound the hunters. Get out the OSCAR antennas and try it!

If you have unlimited real estate available at the hiding site, try a setup like the one in Photo A. It shot lots of signal down the canyon, where it was several miles to the closest road. But it gave very little signal to the rear, where the road came within only a few hundred yards.

How about a moving antenna? Peter Ernster WA6TQQ adapted a motorized camera pan-tilt mount to slowly change the polarization of his yagi from vertical to horizontal and back again, giving a very interesting effect. Wes Printz KA3DSE made a similar setup using a windshield wiper motor.

Other hiders rotate their beams in azimuth, to "light up" the nearby hills in various directions. If you're with the T, you can turn the antenna manually. For an unattended setup, add a motor, as shown in Photo B. Use a mechanism that sweeps the beam like an oscillating fan instead of making it go in circles, so you don't need slip rings in the coax line. The antenna should move slowly so that the effect is not too obvious.

Photo A. Gary Holoubek WB6GCT (pictured) and Tony Levand KA9WGO assembled this 16' long circularly polarized beam with a 6' x 6' screen reflector in a wilderness park for a Fullerton Radio Club T-hunt. It put lots of RF at the far end of the canyon, but very little signal at the road just behind it.

Stay tuned for more dastardly hiding ideas in future columns. Let's also hear about what you have hidden and hunted. Send stories of your local foxhunts to the address above. Photos are welcome, too.

Convention Fun

You say there are no T-hunts in your area, and you have never had a chance to lay eyes on any RDF gear or see how hunting is done? Consider coming to the ARRL National Convention, August 20-23, near Los Angeles International Airport. Not only is T-hunting on the technical program agenda, but there will be an abundance of hunts, put on as official convention activities by the Fullerton Radio Club.

Don't be surprised if you see hunters "sniffing" in the aisles. They will be seeking the miniature fox-boxes scattered throughout the convention center. If you find one of the official T's, you'll win a nice trophy to impress the hams back home. Portable RDF gear will be useful for this pursuit, but not mandatory. You might get lucky and find a T with just your 2 meter handheld, using the "body shield" technique.

There may be a few unofficial signals to hunt, too. The T-hunters of Southern California will probably bring all their toys, including foxes of all shapes and sizes.

For intrepid do-or-die mobile T-hunters, there will be a no-boundaries Southern California style mobile hunt on Sunday, with some very worthwhile prizes up for grabs. So bring all your gear and plan on a weekend of RDF fun. If you're still a T-hunt wannabe, come out to the start point and see all the neat gear the hunters have put together.

It's unfortunate that only a few ham conventions each year offer RDF contesting as part of the official program. If you're on the planning committee for a hamfest or convention, why not add

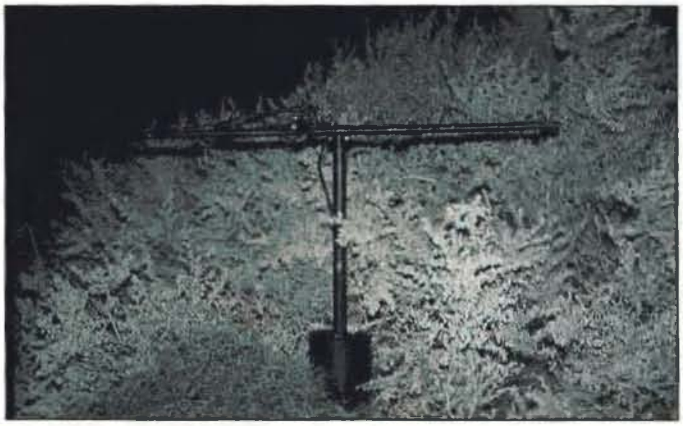


Photo B. Kevin Kelly N6QAB built this motorized quad when he put on a long-distance hunt in the Albuquerque area. It automatically turned back and forth to vary the signal reflections from the nearby hills.

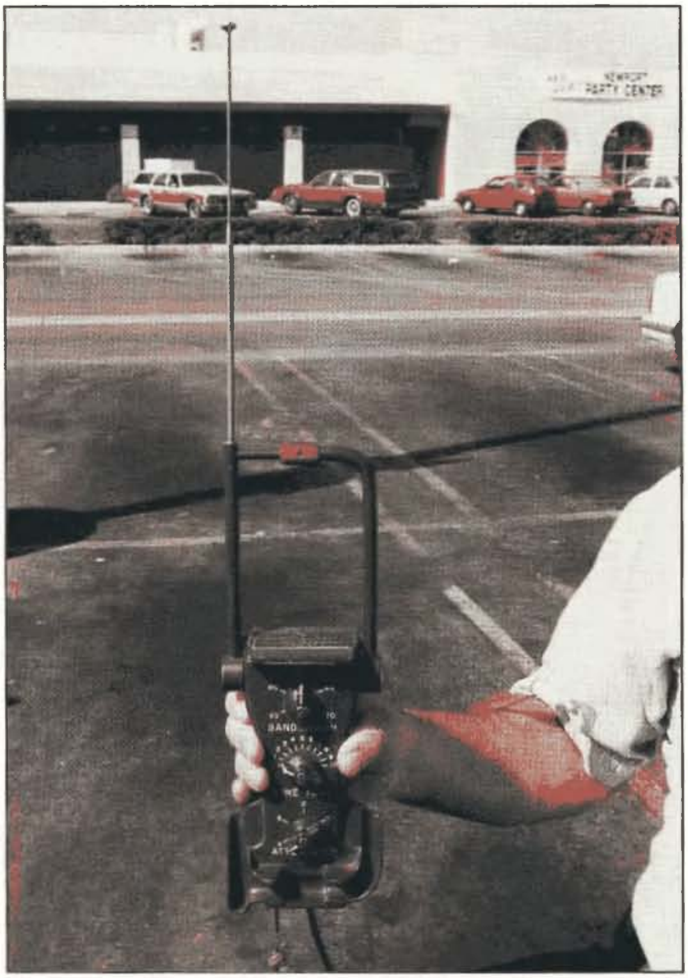


Photo C. *The military has used low-band VHF frequencies for many years, so there is a variety of surplus RDF equipment available. This loop-sense unit works fine for T-hunting on 6 meters with no modifications.*

a T-hunt as a change of pace? If you do, be sure to let me know at least three months in advance so I can mention it in this column.

A Surprise on Six

It isn't long before every new ham discovers that our band allocations are not exclusive. We dodge foreign broadcasters on 40 meters. On 70 centimeters, we live with oil well locators, shipboard radars, and wind profilers. The 902-928 MHz band is a wasteland because of vehicle locating systems, computer networks, and home video links, with more new gadgets to come.

One band that has remained relatively free of non-ham QRM is 6 meters. For a few days out of the year, there are radio fireworks there, everything from E and F layer openings to tropo, auroral and meteor contacts. The rest of the time, it's a quiet bit of spectrum, perfect for local QSOs and foxhunting.

The Southern California Six Meter Club (SC6MC) has sponsored a monthly T-hunt on 50.3 MHz FM for five years. On the morning of the May 2nd hunt, the hider and hunters were astonished to find their radios alive with military communications. The California National Guard had set up shop on numerous frequencies, including 50.3, as guardsmen patrolled the streets of Los Angeles.

Hider George Stokes WT6U was 20 miles from the nearest guardsmen, but why take any risks? The group quickly decided not to hold the 6 meter hunt.

Fortunately, WT6U had a 2 meter mobile rig with him. There was a quick QSY to 146.565 MHz. None of the hunters had brought mobile RDF equipment along for 2 meters, so everyone used their handhelds with either their 6 meter untuned loops or body shielding. Eventually, all teams found George.

The military has used low-band VHF for communications links for dozens of years. Radios range from 30 to 88 MHz, but communications officers usually take pains to avoid using active TV channels and the 6 meter ham band within U.S. boundaries in peacetime. This was an exception, but there were no complaints forthcoming from the hams.

A benefit of military access to this part of the spectrum is surplus equipment. Besides radio sets, you can find ready-to-hunt RDF equipment, such as the loop shown in Photo C. Several SC6MC members hunt with similar antennas. One source is Fair Radio Sales, 1016 E. Eureka, P.O. Box 1105, Lima OH 45802-1105; (419) 227-6573. 73

QRP

Number 14 on your Feedback card

Low Power Operation

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What's a QRP?

Dayton was a washout this year. Really! The weather was just rotten with rain on and off Friday. The weather Saturday proved to be even wetter, but with temperatures hovering around 40 degrees. Sunday it hailed! There were no happy campers in the Dayton Hamvention flea market this year.

Inside the main building, people were just on top of each other. I could not help but overhear a conversation between two other hams as we were pushed and shoved along in the flow. They were talking about QRP. My head spun around when one guy said, "This QRP sounds interesting. I wonder how much a QRP is and where can I find one." To this his buddy replied, "What's a QRP?"

What's a QRP? How do I get one? How much do they cost?

After all the articles published on QRP operation by myself and others, it seems hard to believe there are people who don't know what QRP is. But what really frosted the cake was my wife asking me what a QRP is.

I tried to explain to her about the International "Q" signals, and that if you send "QRP" with a question mark it means you're asking the other guy to reduce his transmitter power. And that sending "QRP" without the question mark means you have already reduced your transmit power. She replied, "Reduce it from what to what?" Well, she had me there.

There seems to be a very overlooked rule and regulation regarding transmit power of an amateur radio station, Part 97.67, Section B. In a nutshell it says to use the minimum amount of transmitter power necessary to carry out the desired communications. This area becomes a huge trouble spot.

You plop down some money, open up the box and remove your new radio. Plug in an antenna and microphone and you're on the air with about 100 watts of RF. If you're talking to Joe Ham, and you are both running 100 watts, and have a 40 over S-9 signal, you more than likely have just violated part 97.67. No big deal. The feds have better things to do than run around with Bird Thruline™ wattmeters checking on output power. (Although, they did do a survey on operating power awhile back.) As I told her, it becomes very muddy water as to how low you can reduce power to maintain "desired communications." Just what is "desired communications"? Would an S-meter reading of 7 be "desired communications"? How about an S-meter reading of nothing, but you can hear and understand everything Joe Ham is saying? There are too many questions for any one person to be able to say when to reduce power. For the most part, if the transceiver you're running can produce 100 watts, 100 watts is what you'll be running it at. In some transceivers, reducing RF output throws transmitter efficiency in the dumpster.

It's like the guy with the amplifier sitting next to the transceiver. "I only use it when I need it," says Randy as he reads the log book by the glow of a pair of 3-500Zs. Right! The same thinking goes with adding a turbo charger to a V8 engine, "Just in case I need it." Of course you'll use it. That's why you purchased the amplifier to begin with, to use it. No one is going to pay for an amplifier and never use it.

After I explained all of this to her, she still wanted to know what a QRP is. So, I had to put the definition of a QRP into something she could understand. What better way than to let her in on some of the action on 20 meters phone.

I fired up my trusty Argonaut 509 and started tuning around looking for DX. I find DX by listening for the pile-ups. Works every time. I found a huge pile-up right dead in the middle of the advanced band segment. Seemed like a volcano erupted a week or so ago and half a dozen crazed DXers (What's a DXer? Next lesson.) flew in by helicopter to play radio.

The DX station was just working the loudest stations, in no particular order. I called, called some more, and called again. I tuned up higher, tuned down lower, increased the mike gain, lowered the mike gain. I checked the beam heading, moved the beam a bit one way, then the other way. Went outside and checked if the beam was still up on the tower. I checked the antenna connectors, called again, called some more. I checked the SWR; yes, it was 1:1.3. Whoa, way too high. Out came the antenna tuner, SWR now 1:1. Called some more. A second trip outside to be sure I hadn't cut the feed line with the lawn mower. I called again. I started to scream into the microphone. What's wrong with that guy? Can't you hear me calling you with my 2 watts? Whatsamatteryou! My wife then asked me why I did not turn on the "big radio" like the other people. What, and ruin all my fun? This was a Kodak moment.

After working 47,489 contacts, the DX station went QRT, leaving me out of his log book.

A State of Mind

So what is a QRP? QRP is a state of mind. It's trying to make contact with another station using the least amount of RF power. It's a way of looking at things from a slightly different angle.

For the record, QRP is officially recognized by the QRP ARCI as 5 watts CW RF output power and 10 watts PEP output for SSB work, regardless of the input power. Milliwatting, or the older QRPp term, is power under 1 watt RF output.

Look for QRP operators on the following CW frequencies: 3560, 7040, 14,060, 21,060, and 28,060. Check too on 7030 and 7060 for DX QRP operators. Look for foolhardy QRP SSB operators on 3985, 7285, 14,285 and 28,885.

How much does a QRP cost? Anywhere from the price of a Fireball transmitter all the way up to an Argonaut II and everything in between the two.

QRP: A state of mind in doing more with less power. 73

Number 15 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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Using Surplus Parts

This month I will cover a few ideas developed by obtaining items from the surplus electronics market. There are many benefits to using items from surplus but, as in all purchases, you must make the final determination as to just what is a wise purchase. Remember, consumer desire for acquisition must be bridled with a few responsibilities in making a good choice. Don't be tempted to start a new business venture just because you've found a large quantity of left-handed widgets; evaluate the item first. What might seem too good to be true on the surface might be lots of work underneath. Don't count surplus items out, but do use normal good judgement. Sometimes I even ignore my own advice and buy the entire lot, only to discover later that it was not such a hot deal. I stress *buy one* as a disposable education evaluation, and if it is proved out—by yourself or someone you know—then recommend the product. In the same light, don't take on a project too ambitious and expensive—it's a hobby and should be for enjoyment.

I remember a good friend who built an SSB transceiver and purchased all components right from the parts list specifications in the article. The total cost incurred was excessive; he could have saved a very large chunk of cash by using surplus or swap-meet substitutes for specified items. Unfortunately, this project did not have a happy ending. He installed numerous shorted cables without verification and assembled the entire unit without step-by-step testing. There were so many different troubles that it became an insurmountable repair task to make it work, and it ultimately became a source of components for other projects. A very expensive lesson in home construction.

I have made my own mistakes and hope that my description of them will save you from making the same ones.

Never Risk "The Farm"

Projects are supposed to save you money, not become a sink hole into which you pour cash reserves. Don't take on a project that is too ambitious or complex without seeking advice or help from someone who is experienced in large construction projects and can offer assistance. This will save you money in the long run.

The most important step in any project is to make a long-range plan and set goals for aspects of the hobby you would like to explore. Look at several different publications for information on items to construct and use them as a guide to form a shopping list of items needed to reach modest goals. Then take time to fill the shopping list, looking at swap meets. If you slowly gather items by bargain hunting, the cost of a project can be significantly reduced. Build up a junk box of usable components in the general parts category. Standard value resistors, capacitors and such can be removed from junk circuit PC boards at very little cost, and can stock a good junk box. Time is expended here, but at quite a savings. You may say it takes too much time to unsolder components in a salvage operation. Well, let me tell you a little secret—a PC board can be mass unsoldered by several operations.

One method that I do not recommend is the hot peanut oil technique. This operation can be quite unsafe because the oil is heated to solder-melting temperatures and can splatter during the unsoldering operation. Very unsafe. A simple alternative that can be used quite easily and safely is the hot air blower. This blower is the same tool that is sold in most well-stocked hardware stores to blister paint for removal. The blower looks much like a ladies' hair drier, except that it can reach solder-melting temperatures in a few minutes of board heating. I have successfully removed 40-pin chips with this technique and saved the chip intact.

However, I have had difficulties with some plastic parts because they tend to deform in the heating process. I had trouble with plastic coil forms for small IF transformers because they required a little coaxing after the solder was molten. They were a tight fit and this contributed to the coils' demise because of the pressure needed to extract them after the solder was molten.

I usually keep the hot air blower about a inch from the region I am heating. In about two to three minutes the parts will just fall off. When they are loose, just tap the back of the board and the parts will drop in front of the PC board.

Keep the blower on the board to retain heating and move to the next area to be unsoldered. If this region is adjacent to the first it is already preheated and component removal is almost ready in 10 to 20 seconds. I have removed all components from a PC board that measured 15 by 20 inches in about 15 minutes of relatively easy work.

CMOS devices and other chips can be removed with a small variation. Some will drop off, but I prefer to place a small heat sink on top of the chip, using a pair of gas pliers. When the chip is ready to be pulled off, don't rush the operation; wait a few seconds after the point where the solder will permit the chip's removal. These extra seconds will allow removal of excess solder on the top of the board that might cling to the top of the chip's pin after premature pin removal. If you wait just a little, the pins look factory-fresh when the part is removed. Parts so removed can be sorted, and you will be amazed how fast your parts junk box will build up, saving on the cost of future projects.

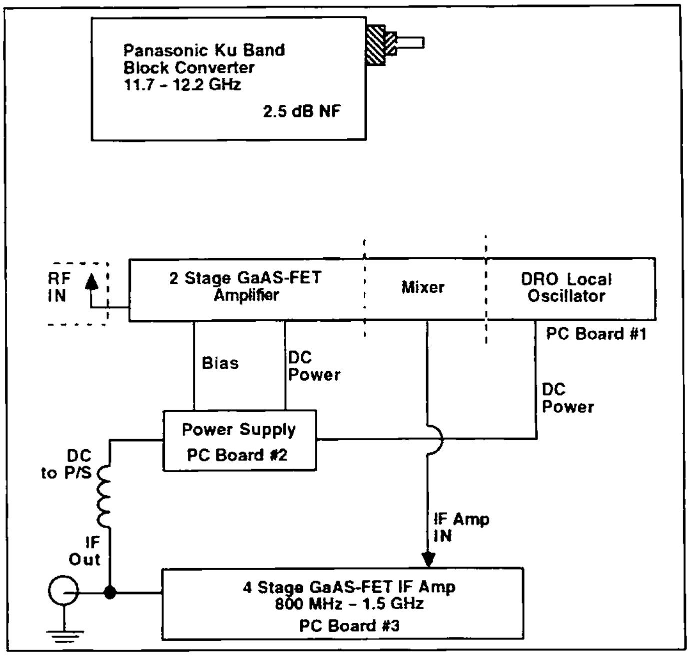

Figure 1. Ku band converter.

Eventually some key items have to be purchased for any construction project, but try to find these parts in a careful search. Sometimes a friend might have that part and that's a swap in the making. I constructed a receiver for HF when I was given my first Collins Mechanical Filter (a long time ago). Today my interests are in the microwave spectrum and as such I constantly look at the surplus market for items that can be re-used to advantage on our higher frequency bands. Anything of value from 30 MHz up can find a new home and be put to good use.

An example of a surplus item that is starting to filter down to dealers is the 12 GHz (Ku Band) satellite downconverter. The reason they are available in surplus is their higher noise figure, something running from 2 to 3 dB being typical. The nominal cost for a used converter head is under $15. You might say, what can I do with one? Well, disassembly of a unit will give you three printed circuit PC boards loaded with components. One board (under a cast-metal cover) contains a 12 GHz RF amplifier (two-stage GaAs-FET), a single diode mixer at microwave, and a Dielectric Resonant Oscillator (DRO). The second PC board is the power supply for the amplifiers, and the third PC board is the output IF amplifier. Usually this amplifier is a four-stage unit capable of 30 dB of gain from 800 to 2000 MHz. The noise figure of this amplifier must be quite good to retain the downconverter's total noise figure and function (I believe it to be in the 1.5 to 2 dB range).

Now if you separate the IF amplifier you have an excellent RF preamp with high gain for varied applications as it sits.

All you have to do is add coax connectors and connect a power supply (12 volts DC) to finish it. The IF amplifier normally covers the 900 to 1500 MHz range and will function slightly lower and quite a bit higher in frequency from its design frequency. This can make a good low-noise weather satellite RF amplifier, 1691 MHz or even a 1296 MHz RF amp. Kerry N6IZW and I are even thinking about using these for a first IF for SSB operation to remove our mix products for microwave operation. Considering the cost of about $5, and the three PC boards in the original unit, this is quite a bargain.

Even the junk enclosure that previously was discarded can be recycled as scrap aluminum. The remaining RF amplifier (12 GHz) can be cut away from the DRO oscillator and by attaching coax connectors and some shim brass to form a box enclosure for the amplifier you can render this unit usable. Further modifications are possible if you remove the matching stubs on the amplifier's stripline and retest the unit with the drive on 10 GHz. It is possible to retune the amplifier down to the 10 GHz amateur band with good results.

Retuning is done by watching gain and applying snowflakes (very small copper scraps Super-Glued to a toothpick). Moving the toothpick tuning tool will indicate where to attach snowflake bits of tuning copper. Solder them down to the stripline, watching for gain increases.

They will work just laying on the line during test procedures. Other copper bits are added to peak the amplifier as adjustment progresses.

As you near final adjustment, some of the first copper snowflakes might

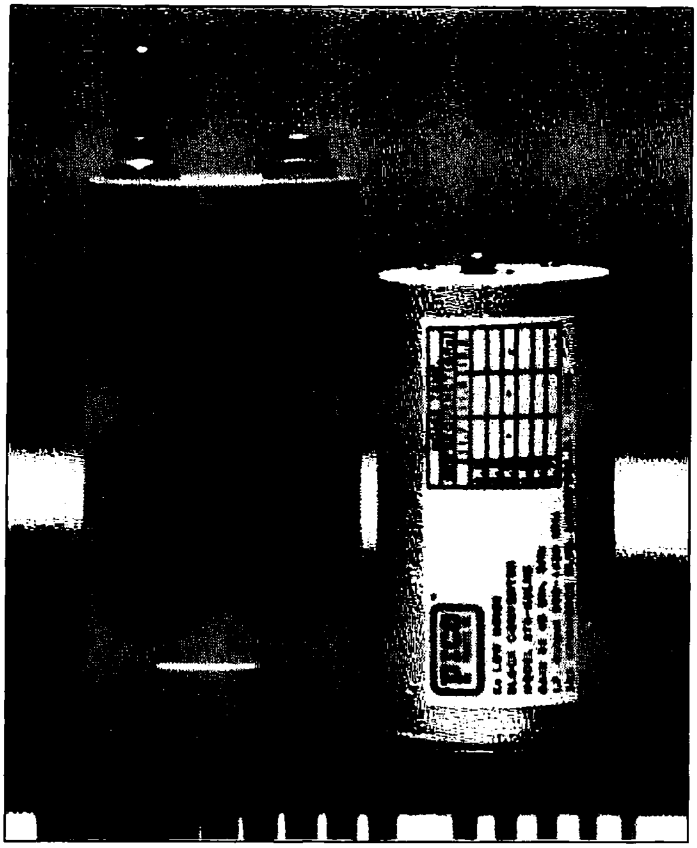

Photo A. An example of Ku band (12 GHz) block converters, which contain many usable PC boards.

have to be re-adjusted slightly to remove interaction. When you are satisfied with what gain you have obtained, start soldering the snowflakes in place one at a time.

This process can be tedious but is no more complex than building an amplifier from scratch. The time required is about the same to construct a new unit or modify an existing unit. The main benefit from surplus parts is the low cost.

Remember that you are dealing with static-sensitive devices and as such use a static-free work station along with a temperature-controlled low voltage soldering iron. Wrist-static grounding straps tied to a work bench grounding assembly/modification station will help prevent device damage. Make sure all the grounding is good and that your soldering iron is in the common grounding loop with your work piece. I use a large scrap copper plate for my common work surface for modification or assembly. The soldering iron and all work tools are tied in common to this copper plate. I am tied into the plate with a low current conductive high resistance safety wrist strap. Direct connection is not necessary. I touch the plate before any pickup or other parts (GaAsFET) placement to remove possible static charges. They (static, 5 to 6 volts) can destroy your FET. If you have any difficulties working with FETs, start out with low-cost ones or surplus devices until you feel comfortable working with them.

The point to make here is that cost can be reduced with a reasonable amount of involvement on your part. Don't be disappointed if some of your first projects don't turn out well. In the beginning we all fail at first, but with a little persistence and application most projects change from a doorstop into something usable. If you get into difficulty, drop me a line and I will try to help you out and get your project working. In one respect I went off the deep end long ago in that I have set up a good test and calibration bench able to work on most anything, more test equipment than operating amateur equipment.

Mail Box

Ed Barbacow K3ZCY from Carmichaels, Pennsylvania, writes that he has just obtained a 3/4 -40 tap. Big deal, you say? You bet it is! That is the "custom special" needed if anyone wants to use a 416 variety microwave tube. This tube is capable of several watts of power on bands up to 5 GHz, making it quite good news. Ed is offering to help others out with nuts tapped for this 3/4 -40 thread to use with the tube in an amplifier. This was a big stumbling block in previous years. Drop Ed a line at 330 Ceylon Rd., Carmichaels PA 15320-1354. Also, Ed is looking for a waveguide for 5.6 GHz. He needs a straight section of Wr-137 (about 7 to 10 inches long, with flanges). He is experimenting with a waveguide filter for 5.6 GHz.

Al Berry NZ5W of Panama City Beach, Florida, inquires if the CW IDer is still available, and if so, is the cost still $12.50? Yes it is available, and the cost is the same. That is, as long as I still *have* surplus EPROMS available to program. That is what helps to hold down kit cost. Other kits that I offered have not fared so well, such as the 30 MHz transceiver for 10 GHz Solfans (Solfan special). The IF chip (a TDA-7000 from Signetics) is becoming hard to get, and currently I am out of stock. I will try to rectify this kit or redesign it with another chip type.

Larry Chrisman K9OXX reports that he now wishes he'd bought a life subscription to *73*, since *HR* folded. He states that *CQ* has gone downhill ever since they dropped the surplus conversion/VHF RTTY and other experimental stuff from the magazine. Larry said that's why he canceled his subscription. One question he asked concerns the Stereo Solfans alarm units for 10 GHz. He wonders about their specific applications. Can they be used with a standard 30 MHz IF strip? The answer to your question is yes, they can, but you do not need both detectors for WBFM operation.

The alarm application needed the dual detectors which operated in stereo to give additional information to the alarm sensors. The benefits of dual detectors versus single detectors is that dual units can detect movement and determine if the object is approaching the detector or moving away from the unit. The alarm unit can be set to report on movement towards the unit only and ignore movement away from the unit. This is one modification to reduce unnecessary alarms. Newer units use both stereo detection and an optical scan (IR). The unit can be set up to require both optical and microwave return to verify actual movement. This prevents false alarms.

Larry states that he spent lots of time in San Diego and remembers the many different surplus electronics dealers in SD from his service days in the '60. He spent many hours browsing and picking up goodies then. Now his home town doesn't have much more than Radio Shack and hamfest flea markets—not much for the experimenter. Well, that's just the reason why I try to put together modest-priced items that I run into from time to time—to help out on some of the projects that I describe in the column. I call these items the key parts; in the microwave spectrum I have come to call them "UNOBTAINIUM" due to the difficulty in procuring them at reasonable cost. There are many different mail order houses and selections to make even in San Diego. I usually find a new one sprouting up every so often, that helps to keep up on bargains.

As long as they're small, my wife will let me keep my newest acquisitions. Because newer hams coming online are anxious to get started, they seem to have a hard time finding bargains without getting sold a bill of goods. There are lots of dealers out there, but some don't advertise all the time.

Next month I will cover a surplus power amplifier for 10 GHz that was available from Halted Specialties. As always, I will try to answer your questions on microwave and related activities. Please send an SASE for a prompt reply. 73, Chuck WB6IGP.

RTTY LOOP

Number 16 on your Feedback card

Amateur Radio Teletype

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The ASR-33

With all the high-tech talk these days, we often lose sight of the fact that, for many hams, fancy computers and tho like remain an unattainable goal for a variety of reasons. This hobby of ours continues to encompass a wide range of preferences and directions. Several letters this month illustrate the case well.

Eugene "Mac" McAleer N9DUW of Addison, Illinois, responded to my comment alluding to the old ASR-33 sitting in my basement that I have trouble parting with. He relates being "in the same predicament here. My '33' was donated by a fellow ham who saved it from the junk yard for me. It is like the day it was built. Actually, I would like to use it but need some information for a converter for 60 and 100 wpm Baudot to 100 baud ASCII for the machine. The only input seems to be a phone line. Powered up, it types just fine.

"So hopefully you can supply me with some information or tell me where I can obtain some. I am an avid RTTY art fan and have a collection of some 1400 pix. I presently run a Model 28 for pix hard copy along with the glass TTY IBM compatible. Our ham club runs a VHF RTTY repeater with a great deal of activity on it, including a pix net one night a week."

Well, first off, Baudot to ASCII conversion was a hot topic in the early-to mid-1970s, before the personal computer revolution took off. Several such schemes were published here in the pages of *73* during those days, and a search of back issues turns up many solutions. I have sent a list of some such solutions to Mac. If there is enough interest among the readership, I would be happy to review some of the techniques here. Alternatively, just hooking the ASR-33 to the serial port on the computer, with some suitable programming, might be enough to make the thing run, without having to re-invent the wheel. I am sure someone out there is still doing this, and will share his or her technique with us.

The other topic you mentioned, Mac, RTTY art, was one near and dear to my heart many years ago. I even went so far as to translate one or two pictures onto an automated Selectric typewriter I used at one summer job, with pauses built into, shall we say, critical areas. At one time, samples of RTTY art were featured here in "RTTY Loop," including the annual contest. Having heard nothing from that quarter in many years, I assumed that such activities were passé. If you or others with interesting or unusual works of RTTY art would like to forward them here, I would be happy to consider them for inclusion in an upcoming column.

DesqView

Accelerating at Warp 8 from the vintage to the vanguard, I received a letter from Rick Arzadon WA8RXI of Taylor, Michigan, who is looking to run what may be the supreme RTTY computer station. He says he is "seriously contemplating acquiring DesqView to run three or maybe four programs concurrently. What I essentially want to do is be able to switch between logging, a QSL manager/database, 2 meter packet, and HF digital modes, without losing a beat monitoring packet at the same time as holding a digital QSO (RTTY, ASCII, AMTOR, etc.) on the HF rig. I believe with the equipment I have I can accomplish this using DesqView.

"The equipment here includes a Kenwood TS-830S, Kenwood TR-7400A, AEA PK-232MBX, and a 386SX computer running MSDOS 5.0, without Windows.

"Now, I guess my major question is, has anyone successfully modified a PK-232 either by hardware or software to make it act as a dual-port modem? Or, would it be better for me to add the PCB-88 or a similar board for VHF packet only to my system? Or, do you know of a system that will allow me to multitask amateur radio programs without going to a program like DesqView?"

Whew! That is a tall order, Rick. First off, I don't believe there is any way to make the PK-232 a dual-port machine. There is too much shared circuitry, when I look at the book, to be able to accomplish this with massive modification. The Kantronics series of interfaces do incorporate dual-port design, to my knowledge, and they may well have served you better in this quest. Alternatively, you may be able to add another terminal unit, such as a dedicated board in the computer, to add the second channel capability.

As to the multitasking, you have several choices. A limiting factor may be, however, the computer you are running. You will need sufficient memory to allow all these programs to run unrestricted, and using several COM ports at once, such as may be required if monitoring packet and sending on HF RTTY, might cause some interrupt conflicts. DesqView may well be able to accomplish the task. From what I have read of this program, it seems to be able to robustly mix a variety of programs in a multitasking environment. Windows 3.1 is a lot healthier than its predecessor, and with adequate memory, running in 386 enhanced mode, it may do as well also. Then there's OS/2. Just starting to appear on dealers' shelves, reviews of OS/2 indicate that this might be just what you're looking for. You will need plenty of memory and hard disk space, though.

Somehow, I think that among our readership there is someone who has already braved these waters, and I look forward to receiving reports of these accomplished explorations. If received, I will pass them along in future columns for the benefit of all.

Howard Halperin N7ETP of Phoenix, Arizona, is looking to hook up his Kenwood TS-430S transceiver, with a PS-430 power supply, SP-430 speaker, and AT-250 antenna tuner on RTTY. His question, "How?" The answer, "simple!"

As we have elaborated over the past few months, all you need is an interface and terminal. This can vary from one of the older interfaces, such as the ST-6 popular many years back, to one of the new multimode controllers. Ask around the Phoenix area; I am sure that there will be those to hold your hand while you hook up the equipment. Who knows, maybe a reader of this column in your area will contact you, first!

A few months ago, you all pointed out the new source for old Microlog products. Now, here's a note from A. H. "Monty" Munro NØDSH, who is ISO (that's In Search Of, for those of you who don't read personal ads) another old unit. He says that he is "interested in RTTY/AMTOR but not packet, and the interface I can put on my C-64 to use AMTOR. I have no info about who manufactures the CP-1 and MBA-TOR or a unit like it." I remember ads for these units, but cannot put my finger on them at the moment. Reader input regarding both availability and usability of these C-64 RTTY devices is solicited.

Several of you have asked about the availability of the Color Computer programs offered in "RTTY Loop" several years ago. I am sorry to report that my Color Computer has bitten the dust, and I am no longer able to provide programs for that system. The programs described are available both on CompuServe and Delphi, in the amateur radio and color computer special interest groups. If you do not have access to either service, but have a friend who does, the programs can be downloaded to *any* computer, then you call your friend's computer with your CoCo and download from there. You don't have to have a Color Computer to pick up the programs, only to run them! After all, neither CompuServe nor Delphi use Color Computers as mainframes. If you still don't understand, drop me a note, with a self-addressed, stamped envelope, or buzz me on one of the online services mentioned at the end of the column, and I'll explain it again, step by step.

More goodies next month, with more of your letters, and other items of interest to the digital ham. Meanwhile, communication is invited by letter, or via CompuServe (ppn 75036,2501), Delphi (username MARCWA3AJR), or America Online (screen name MarcWA3AJR).

UPDATES

Number 25 on your Feedback card

VE3CYC'S WIRE BEAM

See the above article in the June '92 issue of *73*, page 18. In the bandswitch diagram (Figure 9), the switching parts (armatures) are drawn the wrong way. They should be connected to the row of center connections instead (see the corrected Figure).

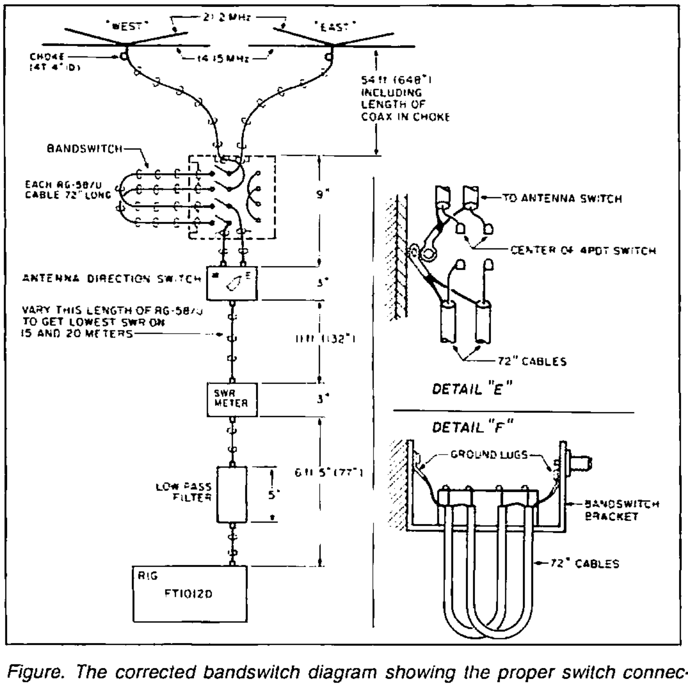

Figure. The corrected bandswitch diagram showing the proper switch connections.

Number 17 on your Feedback card

PACKET & COMPUTERS

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Welcome to "Packet & Computers," *73*'s new monthly packet radio column. Each month I'll take a look at the hardware, software, and networks of amateur packet radio. This column is designed for two sets of readers: the end user of the network, and the sysop. It is my intention to provide useful information to both, but in order to accomplish this I need to know what you want to see here. Let me know what you like and don't like, and more importantly, how I can make things better. The packet radio community is diverse, and this column will reflect that.

More Than Mail

Most packet users nevor get beyond reading and sending mail and bulletins, but there's more out there on the network. Information, stored on database servers, can be accessed from your local PBBS, and access to the Internet—a huge network of institutional, government, and industry computers—is also available.

The White Pages

Don't know the home PBBS of a ham you want to send mail to? Most PBBSs will let you look it up in the White Pages. There are two ways to use this service. First, if the ham you want to know about is known by the PBBS, you can ask directly (on a WØRLI PBBS, others may vary): "I (call)," where (call) is the callsign of the ham whose address is in question. On the other hand, if you are asking, the ham is probably not local so asking the PBBS won't do much good.

Still, there is a way to find out. You can use the White Pages (WP) server located at AD8I. This is a national registry of home PBBSs that probably has the information you need. To get the information, you simply send a specially formatted mail message to WP@AD8I. The commands on a WØRLI PBBS are like this (a carriage return follows each command):

SP WP@AD8I:
(SP is for Send Private.)

QUERY This is the subject line of the message.

(call) This is the call of the ham who you are interested in. It is the first line of message text.

(CONTROL+Z) This ends the message.

The query will be answered within a couple of days by return mail.

Electronic Callbook—REQQTH@WA4ONG

Buckmaster Publishing sells a CD-ROM version of the U.S. *Callbook*, and Jim WA4ONG has seen to it that it is available to any amateur with a packet station. The REQQTH server is accessed with a specially formatted mail message. The commands on a WØRLI PBBS are (a carriage return follows each command):

SP REQQTH@WA4ONG SP is for Send Private.

(call), (call), (call), (call), (call)@YourHomeMailBox

This is the contents of the SUBJECT: line. (call) is a call that is being queried, the list of calls can be separated by commas or blanks. YourHomeMailBox is the address to send the answer to.

(e.g.:N1EWO@WJ9U.IN.USA).

/EX This is the first line of the message text, and the only thing that should appear in the message.

(CONTROL+Z) This ends the message.

The answer to your query will be sent via return mail within a couple of days. It will include the callsign, name, address, and date of birth.

The WB7TPY Packet/Internet Gateway

The Internet is an enormous network of computers owned by corporations, universities and government institutions. The connection allows them to share files and mail, and is designed to facilitate industrial cooperation. There are millions of people with Internet mail addresses, and thanks to the WB7TPY gateway, it is possible to send them mail from packet. The gateway is located at WB7TPY.AZ, and routing mail through it is simple. On a WØRLI board the commands look like this (each one is followed by a carriage return):

SP GATE@WB7TPY.AZ.USA.NA SP is for Send Private.

(subject) Fill in your subject when prompted.

Internet: (a valid Internet address) This is the first line of text. It should be a valid Internet address in the standard format.

(CONTROL+Z) This ends the message.

These are just a few examples of the services available on the packet network. PBBS help files often include descriptions of other services that are available. We will look at others here from time to time, including a frequency database and a project to compile an up-to-date repeater list using packet radio and the Internet.

Life After WØRLI

WØRLI's excellent software is seen on the overwhelming majority of PBBSs (Packet Bulletin Board Systems) in the U.S.. There is a reason for this: It is relatively simple, well-written, and it works! Though some sysops I have spoken with are ready to move on to newer and better things, they often express fear about new software. There is an impression—probably not too far from the truth—that the packet forwarding system is a tenuous and delicate thing. Sysops whose PBBSs serve hundreds or thousands of local users are understandably conservative. Most of the experimental souls are concentrating on the network infrastructure. This is a little safer; either the link exists or it doesn't. PBBSs generally have many possible paths to forward their traffic so no one gets hurt.

On the other hand, a rogue BBS can easily disrupt traffic in an entire region. It makes for some sleepless nights for the poor sysops who worry about such things. There is a problem, though. This conservatism means the end users are stuck with an antiquated, difficult-to-use interface to the packet networks. The ironic part of this is we are stuck with WØRLI because it works so well. It does what it is supposed to, when it is supposed to—as the end user community stagnates. All this is very easy for me to say—I don't have to develop the new software and make it work. But there are other PBBS programs out there right now trying to make a dent in the WØRLI world, and they need some help.

One of the problems with these other systems is that they are still concentrating on the sysop. They provide enhancements for the convenience of the sysop and the forwarding network. You've got the gun pointed the wrong way, guys! We need enhancements to the user interface. There is no question in my mind that the WØRLI forwarding code could be improved, but as I pointed out earlier—it works. If we start seeing some innovation in the user interface, everyone will win. Sysops will sleep peacefully at night knowing that the traffic from their PBBS is moving around the world—slowly perhaps, but smoothly. And the end user—after all, isn't that what this is all about?—will find new fun in packet radio, and not stick to only three or four commands that they have figured out.

Where to Begin?

I have done a lot of talking about improving things, so I will take the first step and make a suggestion about where to start. This stuff is addressed to all you whiz-bang programmers out there who are just dying to implement something new, and to the sysop and end user "customers." You, after all, are the people who will make this thing work—or not.

Client-Server

The Client-Server paradigm (a paradigm is a way of thinking about a solution) takes the greatest advantage of the distributed computing power that is available on the packet network. Has it ever struck you as silly that you take your computer—anything from a C64 to a shiny new 80486—and turn it into a dumb terminal, just so you can talk to another computer? This is a waste of computing power, and is a model from the dark ages of computing. Instead, you should be able to take full advantage of your local computing power to handle all sorts of operations. Note: Before anyone blows a gasket, we do need to keep the terminal interface for those people who are actually using dumb terminals.

If the interface between the client (the end user) and the server (the PBBS) were designed with the idea that the client had some intelligence, it would open up all sorts of possibilities.

Traffic Reduction

A standard data compression scheme could be employed to greatly reduce the number of packets required to send and receive data. This would certainly help reduce the loading on the user port frequencies which, in some places, are overcrowded. If messages were stored in the compressed format, it would also free up precious hard disk at the BBS end.

Batch Mode Interaction

Right now, a PBBS must deal with every packet that comes from a connected station. If the front end were intelligent, a forms-based, fill-in-the-blanks approach would allow the end user to compose all messages off-line, and then send them to the PBBS in a batch. This reduces the time that the PBBS itself is busy. it would also mean that a single PBBS could deal simultaneously with as many connects as the TNC allows, since these connects are not interactive, and disappear as soon as the traffic is passed.

The Power of Forms

Using the forms-based paradigm, users could access all of the services available via the packet network without reading any of the often confusing instructions that are written to explain how. For example, a query to a *Callbook* server would only require filling in the fields in a form—callsign is really all that would be needed. Message formatting would be handled by the client software. A really powerful application for this sort of approach is in emergency communications.

Here in the Midwest, the majority of emergency operations revolve around severe weather. With the appropriate form, a weather-spotter could fill in the observation, which would be forced into the standard format, and then choose send. This would connect to the local RACES PBBS for exactly as

long as was needed to transmit the information—which would only need to be a few bytes, representing the value of the various fields—and then disconnect immediately, freeing the PBBS and frequency for other stations.

Standards

In order for this idea to work, we need to have a standard, efficient machine-to-machine interface. In the amateur radio community, much as in the real world, standards often come from one really good product that gets copied. So, here's your chance to get famous—if not rich. The server end needs to be WØRLI compatible on the back end to facilitate its introduction onto the network. Enhancements to forwarding or whatever can come later. It needs to support a simple, terminal-style interaction for dumb terminals that are out there. It should incorporate data compression, and some sort of solid event tracking so the machines don't get out of sync and confused. And finally, don't design it for today—design it for tomorrow. Remember when 640K looked like the universe?

The other standard we need is one for forms. These forms should be defined by simple ASCII text files. This way, they are easily transmitted across the network by service providers starting new services. The definition syntax needs to support fields, and data types for those fields. Fields must also be definable as required or optional. The first release of the client software must include forms for packet message traffic, NTS traffic, packet White Pages, and the Callbook server. Other forms can follow.

Both halves of this project should be written in ANSI C, with portability in mind. The user interface on the client side should be CUA (Common User Access Compliant) to smooth the learning process. There should be mouse support, and hooks should be included for speech synthesizers for visually impaired hams.

I'm Available

I won't offer this challenge without putting myself on the line. If anyone decides to tackle this problem, I'm available to help with design—I don't do code. This system is sorely needed by the amateur packet community, and besides, it could be a lot of fun. I can be reached care of *73* and on BIX or MCI Mail as jsloman. 73

Number 18 on your Feedback card

HAMS WITH CLASS

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Dayton '92 Youth Forum

Alter months of interviews, phone calls, letters, and faxes, the big day finally arrived on April 25, 1992, at the Youth Forum of the Dayton Hamvention. Few people can really appreciate the amount of hard work, preparation, and anxiety that goes into getting ready for a forum at a national convention. The Youth Forum in particular involves lots of coordination with the youngsters and their parents as well. Fortunately, the folks who run things for the Hamvention are very professional and they help to make sure everything falls into place when it's supposed to.

My concerns ahead of time were twofold. One: I was searching for months for young people who were articulate and enthusiastic about amateur radio. Two: I was hoping that many hams would be bringing non-ham children to the forum as we had been publicizing it in the radio magazines. It's very clear to me that youngsters respond eagerly to their peers who speak about having fun in their hobby.

Happily, all anxieties were for naught. Once we got started, all of the young speakers impressed the "standing room only" audience with their eloquence, composure and their dedication to amateur radio. Even though we were really pressed for lime, I was pleased to be able to introduce some special children in the audience. John Kosakowski KC3TM is the proud dad of two young hams. He brought Ihem along to see the Youth Forum at my invitation after having spoken with them on the CQ All Schools Net a few months ago. Robert KA3WTG is 8 years old and in the 3rd grade at Heights Elementary School in Natrona Heights, Pennsylvania. He's worked 274 countries on CW and SSB. He has already passed his 20 wpm code test and is working on his Extra. His brother Tony KA3WYS is 7 years old. He has worked 171 countries and has made over 600 stateside contacts. He has passed his 13 wpm and is working on his Advanced. Can you just picture the smiling faces in the audience? It was wonderful!

First up to the microphone was Todd Martinson KB9HGE. He is 15 years old and is a freshman at Elston High School in Michigan City, Indiana. His interests are in emergency communications and in DXing. Todd was on CB for a while, and then became friendly with a ham police officer who provided him with license exam information. Now he is a Tech Plus and encourages young people to join the fun in amateur radio and become part of the "family." Todd plans to be a police officer when he grows up and feels that the radio hobby will be a tremendous asset to him in his chosen career.

Our next speaker was Lynn Hummel N3IZE, 12 years old, with a General license. He's in the 6th grade at the Clearlield Area Middle School in Clearfield, Pennsylvania. Lynn emphasized the fact that he got into amateur radio as a family project. He and his parents responded to an ad on local TV for a licensing class. They upgraded and got involved in recruiting school children, always as a family project. He told the children in the audience to consider getting their licenses so that there can be lots of activities on the radio that mostly children could be In together.

Angie Fischer KBØHXY is 13 years old and has a General license. She is president of the Gateway to Ham Radio Club at the Sacred Heart School in Valley Park, Missouri. I've spoken with Angie on the air, and her enthusiasm for the hobby is obvious to the children who speak with her from my class. Angie is very actively involved in recruiting other youngsters, believing that kids do the best job of "selling" ham radio to other kids. With the help of her mentor, Dave Novak NØDN, she produced a "rap" song extolling the virtues of Morse code. Angie has been selected as the recipient of the 1992 Westlink Young Ham of the Year award. Yaesu USA Corporation presented Angie with an expense-paid trip to the Hamvention where she received a plaque from *Westlink Report* and a major equipment gift from Chip Margelli of Yaesu at the end ol the Youth Forum.

Daniel Savio AA2GM is 11 years old, is in the 5th grade and has an Extra class license. He's from Ridgewood, New Jersey, where he first became interested in Morse code at the age of 4. He's always been interested in electronics, and used to watch his dad work with his oscilloscope and computers. Daniel has been building many different electronics projects since he was a little boy. He amazed the audience by explaining his interest in high technology. He loves digital communications, like packet radio, AMTOR and RTTY. Daniel is trying to get the DXCC in CW. He also enjoys working other stations by satellites. He explained to the youngsters in the audience that ham radio has helped him with his studies in school, such as geography, science, math, and foreign languages.

Next up to bowl the audience over with her wonderful presentation was Christina Witkowski KC6YUT, 13 years old, from Glen Ellen, California. She attends the Altimira Middle School where she is a 7th grader.

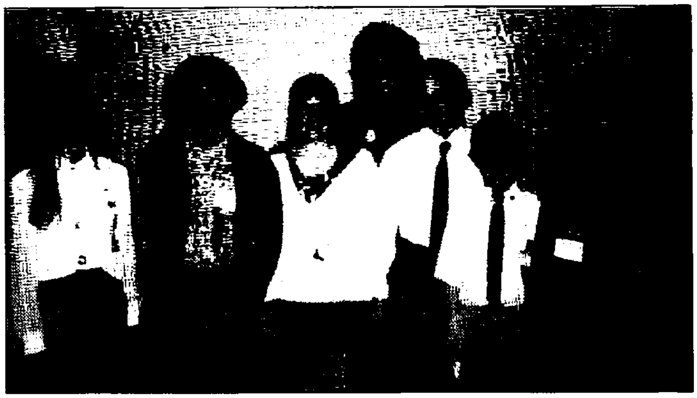

Photo A. Left to right: Angie Fischer KBØHXY, Travis Wise KB8FOU, Christina Witkowski KC6YUT, Carole Perry WB2MGP, Todd Martinson KB9HGE, Lynn Hummel N3IZE, and Daniel Savio AA2GM.

Christina has a Tech Plus license and is a joy to speak with on the radio. The children in my ham radio classes look forward to speaking with her on the CQ All Schools net where she olten checks in from Mr. Burnell's classroom where she is a teaching assistant. Mark Burnell KB6ZOL is an old friend of the school net. Our classes have spoken with each other on the net, and have followed up with pen pal letters and school video exchanges through the years. There have been occasions where I had to step away from the radio for a few moments during the net, and I had no qualms about leaving Christina as net control until I returned. Her dad, Mike KC6YUV, is also a regular check-in to the net with his students from the Dunbar School.

Last, but definitely not least, was Travis Wise KB8FOU from San Jose, California. He is 16 years old, has a General license and attends Del Mar High School. This mature young man happens to write a column called "Tho Youth Forum" in *World Radio*. He told of how he helped out with emergency communications following the 1989 Loma Prieta earthquake. He explained how learning to communicate under pressure has helped him in school and in the rest of his life as well. Travis's family utilizes the radio to keep in touch with each other. He encouraged people in the audience to think of ways that they can expose youngsters to the benefits of ham radio. He suggested doing demos at schools, Scouting meetings, and places where young people congregate. Travis stressed how ham radio can open doors to employment, excitement and adventure.

The Youth Forum at Dayton is a place to showcase young people who are enthusiastic about what the hobby and service has to offer. All the youngsters I've been fortunate enough to be involved with at the forum are deserving of all our praise for they are truly the future of amateur radio. 73

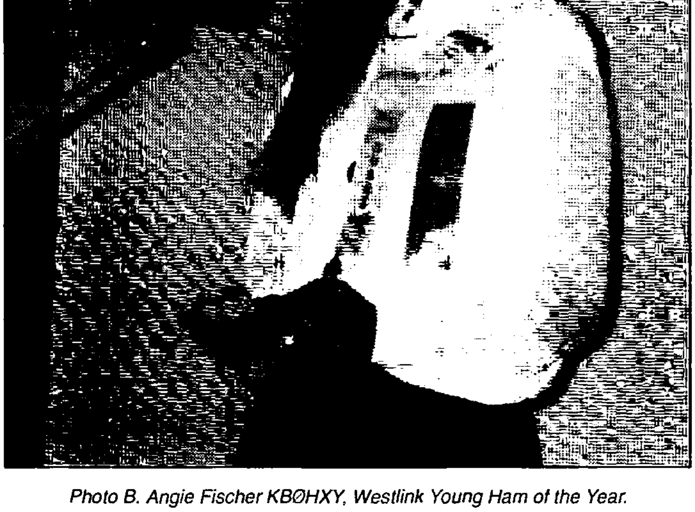

Photo B. Angie Fischer KBØHXY, Westlink Young Ham of the Year.

HAMSATS

Number 19 on your Feedback card

Amateur Radio Via Satellites

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Satellite Portable

The warm months ot summer and early fall are great tor antenna projects and outside activities. Whether it's Field Day, a Scout campout in the woods or just a trip to a nearby lake, the time is right lor experimenting with amateur radio satellite activity.

Most satellite enthusiasts have a set of permanent antennas at home connected by carefully routed low-loss coaxial cable to radios and amplifiers that rarely move out of the closet, study or bedroom. When the always-on computer predicts a satellite pass, they activate the rotators to track across the sky and then make contacts. Why not try it from the wilds?

While checking the white bass population of a beautiful Texas lake, I made time for some serious satellite chasing. Rather than drag along a complete array ot circularly-polarized yagis, I chose simple antennas for the outing. I managed to stuff a small car with a short horizontally-polarized yagi for 70cm, a Ringo Ranger for 2 meters, a base-loaded, magnet-mount whip for 15 meters and a dipole for 10 meters along with some spare and borrowed radios, tood, fishing gear and other necessities.

Before leaving, I checked orbital predictions for every satellite that used the bands covered by the available equipment and brought along paper printouts of convenient passes.

The results were mixed. The fishing was great and contacts via some satellites were excellent, but the high orbiters, AMSAT-OSCAR-10 and AMSAT-OSCAR-13, yielded no QSOs.

For RS-12 with its mode K transponder (15 meters up and 10 meters down) results were consistently satisfying. On the uplink, an NCG 15m monoband transceiver provided 15 watts output for CW and SSB. The power was passed through 50 feet of RG-8X coax to the modified mobile magnet-mount antenna (originally on 11 meters, now tuned for 15) perched on the roof of a nearby van. A Uniden HR-2510 was set to receive the 10 meter downlink using a dipole strung from the eaves of the house. No preamp was needed. Although the selectivity of the HR-2510 is lacking, the sensitivity was very good. Several contacts were made with this setup.

The mode A transponder (2 meters up and 10 meters down) on RS-10 was equally easy to work. An ICOM IC-211 worked fine with the 2 meter Cushcraft Ringo Ranger. A small power amplifier was available but rarely used. The 10-watt output from the ICOM was sufficient for good coverage of each available pass. Some dropouts were noted at very high elevations when the satellite passed overhead, but didn't present a significant problem until later.

RS-14 was operational with linear-transponder activity. Signals from the mode B (70cm up and 2 meters down) system were quite good using the Ringo Ranger and a preamp. I attempted contacts but the short 70cm yagi became a problem. Making contacts and running outside every few minutes to aim it was Inconvenient and sometimes Impossible. If the antenna had been placed closer to the radios or the radios moved outside, the situation would have improved. Check the April 1991 "Hamsats" column for complete frequency charts for RS-12, 13 and 14.

After having made a contact via A-O-13, using only ground-plane antennas, on 70cm and 2 meters while on vacation last year in Colorado, I assumed the Ringo on 2 meters and the yagi for 70cm would be sufficient. They were not. The Ringo Ranger had been mounted above a TV antenna, thus out of easy reach. During the fishing weekend, the satellite was at extremely high elevations, above 60 degrees. The pattern of the vertical antenna favored the horizon and signals from the satellite's mode "B" transponder were uncopyable. If the antenna had been easier to get to, it could have been oriented perpendicular to the computed beam heading for much better reception.

A similar situation existed for mode "J" (2 meters up and 70cm down). Although the 70cm downlink could be heard well with the small yagi and a preamp, no amount of effort with the 2 meter uplink, now running 40 watts, yielded a contact. Although the signal was detectable through the transponder, it was not enough to complete a satisfactory QSO.

Unlike HF operation, where band conditions can send a milliwatt signal around the world, space communications adhere to link-performance equations dealing with effective-radiated power and path-loss figures. The situation never gets better, it only gets worse. The orientation of the satellite's antennas, transponder loading, atmospheric noise and local interference all combine to make the path more difficult.

For any satellite-chasing activity, whether at home, in the car or on the lake, antennas to match the satellite and situation are just as important as the radios, preamps and power amplifiers. Simple antennas work with the low-earth-orbit satellites when the path is short and the signals strong, but they rarely provide consistent results via A-O-10 and 13. Some gain and directivity is needed.

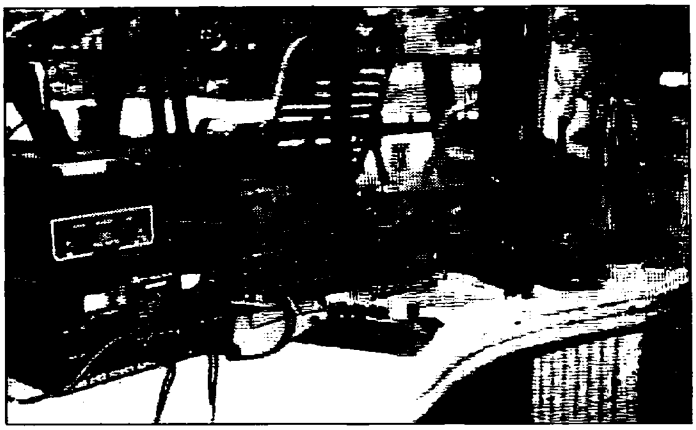

Photo A. A well-stocked portable satellite station for Modes A, B, J and K.

A Portable Answer

AMSAT Area Coordinator Allan Fox N5LKJ has always been interested in making more satellite contacts with less equipment. His article "Poor Boy Satellite Station" in the December 1989 issue of *73* described his efforts with RS-10 mode A using a coat-hanger ground plane on the uplink and some surplus house wiring to fashion a dipole for the downlink. The system worked well and has been an inspiration to many newcomers.

Alter several discussions and some experimentation, Allan has pieced together a simple but effective system for A-O-13 modes B and J. The goal was to find or build an antenna system to be used while on vacation around the United States and Canada. It had to work well, be easy and quick to assemble and disassemble, be lightweight, and store in as little space as possible in the custom van used for the trip.

The final solution came from Mike Duddy of Lightning Bolt Antennas. Mike produces a wide range of HF quads and delta loops ranging lrom simple two-element varieties lor 10

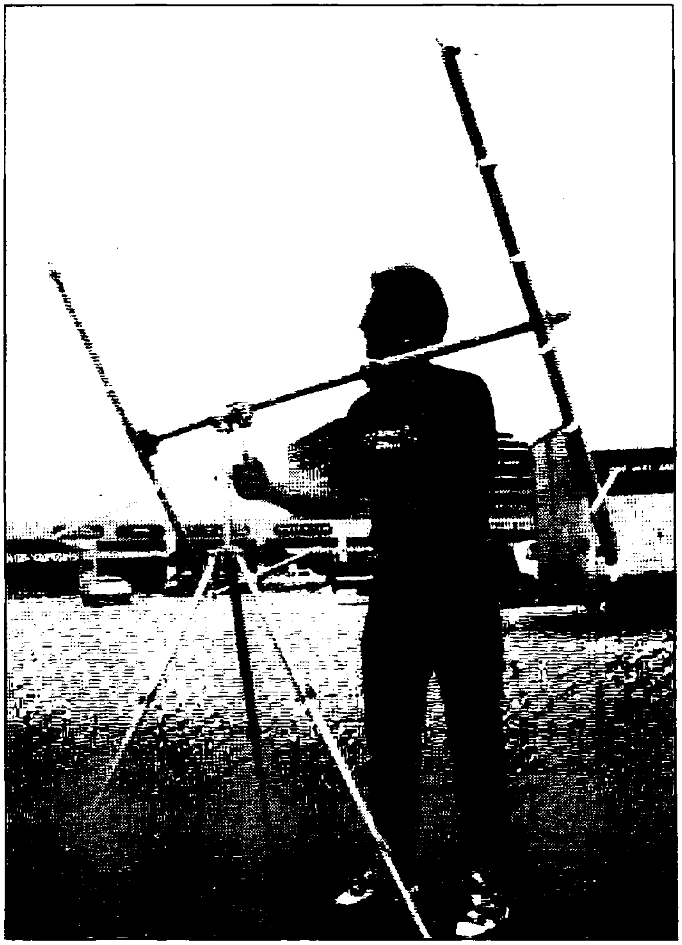

Photo B. Allan N5LKJ checks the array balance and camera tripod controls for the Lightning Bolt OSCAR antenna system. (Photo by WB5RTT.)

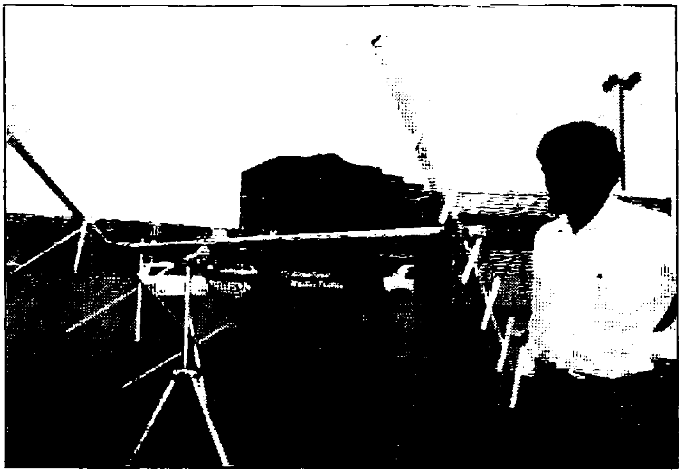

Photo C. *Allan N5LKJ demonstrates the "Armstrong" elevation control on the Lightning Bolt portable satellite antenna system to Andy WA5ZIB (right). (Photo by WB5RTT.)*

meters costing less than $100 all the way to a two-element 40 meter monster for nearly $1,000.

Mike also produces quads for 2 meters and 70cm. One of his dual-band quads with two elements on 2 meters and four elements on 70cm was reviewed by Bill Brown WB8ELK in the December 1990 issue of *73*. The quad elements are all on the same boom, which for satellite work can cause desense due to the full-duplex nature of satellite operation.

Separate antennas on a cross boom like most home hamsat arrays provided the answer. Allan chose a 2 meter, vertically-polarized four-element quad on a square 46-inch boom in conjunction with a 70cm, horizontally-polarized seven-element quad on a square 43-inch boom. The two antennas mounted easily to a round 54-inch cross boom. To achieve good weight balance both antennas have centered mounting brackets.

Allan modified a heavy-duty camera tripod to hold the all-Fiberglas array. No rotators were necessary since the high-orbit satellites move slowly across the sky and the antenna beamwidth is relatively wide. Depending on the position of the satellite in the orbit, up to two hours of operation are possible without re-aiming.

First impressions on the air were excellent. Operating via mode B on A-O-13, Allan used a Yaesu FT-736R transceiver configured for satellite operation with an amplifier to generate about 70 watts output to the 70cm quad. A GaAsFET preamp connected to the four-element 2 meter quad produced easily-heard signals from the satellite. With short coax runs and the radios mounted in the van, Allan made several contacts through an average pass while the satellite was at apogee (its most distant point from the earth).

The complete antenna system is shipped and can be kept in a box 8" x 4" x 5" long. The 70cm quad elements fold down flat against the boom for storage. The 2 meter elements must be completely disassembled, but this doesn't take long. Assembly or disassembly (after some practice) takes about 10 minutes. The elements are made from a rigid special alloy wire so some care is advised. Hardware is aluminum for the mounting plates and stainless for the bolts and clamps. The U-bolts are not, but are treated to prevent corrosion.

Mike specializes in custom designs. Some may prefer a longer cross boom (up to 7.5 feet) while others may want N-type connectors (the standard is SO-239s for VHF and BNCs for UHF). The complete array, including the antennas and cross boom, sells for $114.90 plus shipping from Lightning Bolt Antennas, RD #2, Route 19, Volant PA 16156, or call (412) 530-7396. They take Visa and MasterCard and can usually ship within two weeks or less depending on the availability of Fiberglas parts. The system components can also be ordered separately. The 2 meter quad sells for $39.95, the 70cm quad for $49.95 and a 7.5-foot cross boom for $25. When a portable OSCAR array is ordered, Mike uses dimensions to peak the antennas on 145.900 MHz and 435.500 MHz.

Listen for N5LKJ somewhere in North America during the late summer and early fall. He'll be running the Lightning Bolt antennas along his route from Texas to Alaska, and back again via the East Coast. A-O-13 is his satellite of preference, but he may show up anywhere.

Number 21 on your Feedback card

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DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '92 issue must be in our hands by February 1st. Mail to 73 Amateur Radio Today, 70 Rte. 202 N, Peterborough, NH 03458

Number 20 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: Manual and schematic for a TenTec Century 21 CW transceiver. *Frederick W. Gaines WA3NUG, 264 Hemlock Lane, Springfield PA 19064. Tel. (215) 544-2713.*

Sailors: Ham of 27 years and owner of 48 foot fiberglass sailboat, is seeking a donation of a good 12 volt HF transceiver, shortwave receiver, and antenna tuner in trade for future charters in the Caribbean. *Gary WB4CZE, (813) 463-4570.*

Needed: Donation of Moonraker or any 10 and 11 meter beam. I will reimburse for shipping. Please mark "gift" on package, and send to: *Pedro Bonnilla 5YX9517, Edif Universitario Local 2, Ave. Universitaria, Los Chaguaramos, Caracas, Venezuela.*

Wanted: Source for National INS8073 Microprocessor Chips (built in BASIC). Also, I would like to find a source for Standard Battery Nicad packs for Heath HW24 HT handheld. The battery is marked HWA-110. Heath cannot help in finding a source. *Charles Gelsinger N5PTK, PO Box 72072, Albuquerque NM 87195.* Thanks.

I am trying to locate schematics for a Siltronix Model 1011C, 10 and 11 meter transceiver. Also, schematics for a KRIS model Power Pump, 6 and 10 meter amp. I will pay all copy and shipping costs. *Bob Neal N6FWJ, PO Box 11, Scroggins TX 75480.*

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202-N
Peterborough NH 03458

Alphabet Soup

We hams and other technical types are very fond of acronyms. You know, AGC, ALC, PLL, DSP, and all those other mind-clogging letters that describe the silicon toys we love so much. This obsession even extends to our operating practices; we tolerate QRM, sometimes generate RFI (oops) and generally have a good time with RF on SSB and FM, where we might employ CTCSS and DTMF from an HT. Naturally, we enjoy HF, VHF, UHF and SHF (or is it EHF?). And let's not forget all the administrative stuff. If you're an ARRL member, you can be an SM, OO, OBS (Official Bulletin Station—honest!), and on and on. Ow, I'm getting a headache!

This being a technical column, I thought we'd take a look at some of the technically-oriented acronyms and what they really mean. Some of this may seem pretty basic, but you may find it useful as a refresher. Where appropriate, we'll delve into the specifics as much as possible.

Hams Do It With More . . .

Frequency. The essence of the radio art. Let's see, we've got HF, which stands for High Frequency and, for us, extends from 160 meters (1.8 MHz) up through 10 meters (28 MHz). Paradoxically, this is the part of the spectrum we call the "low bands," simply because we have nothing lower allocated for our use; we have no LF! Even stranger, we call 160 meters, at the bottom of our spectrum, the "top band." Who said all that RF to the brain was harmless?

Moving on up, we come to VHF, or Very High Frequency, which starts at 6 meters (50 MHz) and goes up to 440 MHz. Starting at 440, we're at UHF (Ultra High Frequency), which extends to about 1 GHz, above which the microwave bands begin. Officially designated SHF (Super High Frequency) or EHF (Extra High Frequency), we usually just call them microwaves.

Although there are no actual physical boundaries between the various areas of the frequency spectrum, propagation does change pretty dramatically between HF and VHF, so it makes sense that the two ranges are considered separate. Between VHF and UHF, though, the differences are subtle, so the reason for their being distinct is unobvious. Perhaps it has something to do with the differences in construction techniques required to implement circuitry which will work at those frequencies. At one time, 100 MHz was considered UHF, because it was still exotic and unexplored. As the frontiers of frequency have been pushed higher and higher, some of the frequency ranges have had their antes upped.

Gimme A Signal

Signaling schemes like CTCSS and DTMF arose in commercial services and were later adopted for ham use. CTCSS, or Continuous Tone Coded Squelch System, was originated by Motorola for their pagers and walkies and was (and is) known by their trademark "PL," for Private Line. Because they own the name, though, the generic version we use required some other moniker. Hence CTCSS, which is quite a mouthful. It works like this:

A low-level audio tone is generated by the "encoder" and mixed with your transmit audio. Its frequency can range from 67 Hz to about 250 Hz. Although it often is referred to as a "subaudible" tone, it can be quite audible, especially if one of the higher tones is used. At 67 Hz, many radios' speakers can't reproduce it but, at 250 Hz, they all can, because that is right in the male voice range. The tone sounds like a low-level hum, and I've had many occasions in which I've had my CTCSS encoder on and had a friendly voice break into my conversation to "inform" me that I had a hum on my signal!

When a radio or repeater equipped with a CTCSS decoder receives signals, it keeps its squelch closed until the decoder hears the correct tone, at which point the speaker comes to life. The technique has proven quite useful in situations where two repeaters are interfering with each other. Put them on separate CTCSS frequencies and they don't bring each other up. Naturally, that doesn't prevent interference when both are running at the same time.

Many modern walkies include, or offer as an option, CTCSS encoder/decoders. If you just want to access CTCSS-protected repeaters, you only need the encoder. But you may find the decoder handy as well. For instance, you can use it at hamfests to avoid constantly having your squelch tripped by nearby transmitters (other walkies) on adjacent frequencies. Also, you can use it through non-CTCSS repeaters. Very few hams seem to realize this. If you want to wait for a specific call but don't want to listen to the daily chatter, simply arrange with the calling station to use the CTCSS. Be sure to pick a high tone, though; many repeaters can't pass the low ones. Also, if you have your decoder on, be sure to check the frequency for activity before transmitting, because you can't hear when others are talking. And remember, using CTCSS in no way prevents others from listening to you; it just prevents your hearing them when you don't want to! Obviously, this little selective calling scheme won't work with a CTCSS repeater because you must send the tone it requires to open it up. Unfortunately, you can only send one tone at a time. Or can you?

Number, Please

One of the telephone company's greatest inventions was the DTMF, or Dual Tone Multi Frequency, system. They call it TouchTone. Like PL, that's a trademark, so we have to revert to its generic technical acronym. Originally developed decades ago to provide push-button telephoning, DTMF has found its way into radio in a big way.

The most popular use for it is in repeater autopatching, which lets you connect to the landline telephone network and place phone calls. In my experience, the facility to do that is, for non-hams, a very big attractant to ham radio. Nothing lights their faces up like hearing that dial tone coming from the speaker of a walkie!

Another important use for DTMF is repeater control. Most repeaters can be controlled over the air, using the tones. If you're a repeater control operator, it's awfully nice to be able to turn the repeater on and off, enable or disable CTCSS and control access to the autopatch, using an HT from miles away!

Although walkies have had DTMF number pads for years, only recently have they started being equipped with sequential decoders. These new rigs can decode three- to six-number codes, opening their squelches only when the proper combination has been received. They also can accept several different codes and display what has been received, so you can see who has called. Unfortunately, they all suffer one serious drawback. The coding scheme, which apparently has been standardized in Japan, allows the sending of only the digits 0 through 9; no # or * codes can be sent. Most repeater controllers, which are designed here in the US, can be set to disallow the retransmission of DTMF codes unless they are preceded by a special code. Many control ops set them up that way so that phone patch and control digits can't be heard on the repeaters' outputs. That special code, however, requires the use of the unavailable digits, making the DTMF signaling scheme useless through most repeaters. Of course, you can still use it at hamfests, but CTCSS is easier to set up and works just as well.

What Goes Around

PLL: I've discussed PLLs before in some detail, but let's go over the basics again. First, a PLL is a Phase Locked Loop, and is part of a radio's frequency synthesizer. It compares the frequency of an oscillator with a digitally-derived reference and adjusts the oscillator until it's on its intended frequency. A PLL has *nothing* whatever to do with PL. I hear the two terms confused on the air all the time. Most frequency-synthesized radios made today use PLLs, but there's another frequency-generating design now gaining popularity.

DDS: No, it's not another pesticide. DDS stands for Direct Digital Synthesis. In this relatively new technique, the local oscillator signals are generated digitally and then passed through a DAC (Digital to Analog Converter) to turn them into the required sine wave. Although it requires high-speed digital circuits, the method has distinct advantages over the PLL system because it is not constantly correcting a wandering oscillator, so it has much less phase noise.

The Three "A"s

They are: AGC, ALC and AFC. AGC, or Automatic Gain Control, is the receiver circuit that attempts to keep incoming signal fluctuations from affecting the recovered audio by compensating with the gain of the RF and IF stages.

ALC is sort of the same thing, but for a transmitter. It keeps you from overdriving the transmit PA (Power Amplifier) on voice peaks by adjusting the amplifier's gain. Specifically, it cuts the gain back as peaks occur. ALC is also used to keep the PA from overdriving an external linear amplifier. In that application, the ALC voltage is derived in the linear and fed back to the transmitter.

AFC is a system which keeps a receiver from drifting off the transmitter's frequency. It is usually found on FM radios in the VHF-and-up ranges, especially where there is no crystal or frequency-synthesized tuning.

Watch This

Hams use two forms of television, SSTV and ATV. SSTV refers to Slow-Scan TV, in which video information is slowed down and sent as audio tones representing still pictures. These tones occupy less than the allotted 3 kHz, so the pictures can be sent over HF. ATV refers to regular, wideband, full-motion TV, just like the kind we're all used to, and is found on UHF and higher ranges.

FAX, or Facsimile, signals are simply a paper-output form of image scanning. FAX has its own language, though, because it comes from other radio services. For one thing, there's IOC, or Index Of Cooperation. FAX machines used to wrap the paper around a drum. As the drum spun at some specific LPM (Lines Per Minute), an optical pickup (for transmitting) or a pen (for receiving) would slowly move down the drum, creating an extended spiral pattern of lines and scanning the entire image. The ratio of the speed of the drum to the speed of the pickup or pen's linear motion was the IOC. Although computers are now more common for FAX, the technique and its terms still apply.

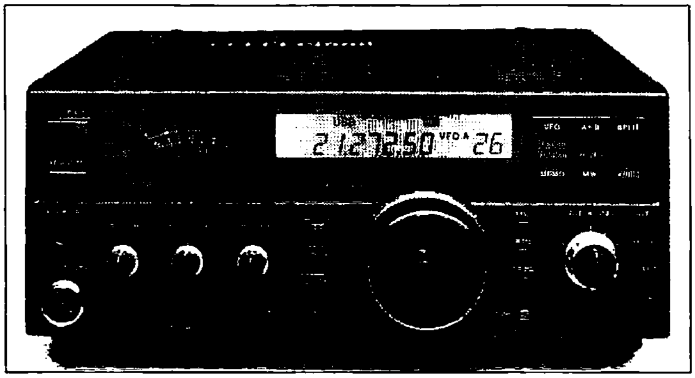
Well, there's no end to the acronyms, but I hope this at least covers some of the more common ones. Don't forget to watch out for TVI, QRM and QRN, and keep the PHT (Powerful Headache Tablets) handy!

73 and see you all next month!

Number 23 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier



ICOM

At the Dayton Hamvention, ICOM America introduced the new IC-728 HF all-band transceiver with high performance features previously available only on higher priced models. List priced at under $1,100, the IC-728 provides advanced operators, DXers and Novices alike with features they may not have been able to afford previously, such as triple conversion, tunable memories, receiver passband tuning, and a 100-watt transmitter with speech processor.

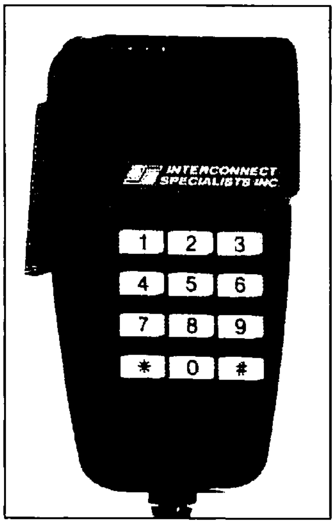
For more information, contact *ICOM America, Inc., 2380 116th Ave. N.E., P.O. Box C-90029, Bellevue WA 98009-9029; (206) 454-8155, (800) 999-9877, Fax: (206) 454-1509.* Or circle Reader Service No. 201.

HART PUBLISHING

John Hart NØOCF, owner of Hart Publishing, has announced the publication of the fourth edition of the *Amateur Radio Mail Order Catalog and Resource Directory*. This July 1992 edition has 220 pages and more than 1,200 entries of mail order products and services for hams. The catalog is categorized and alphabetized into easy-to-find headings from "Antennas" to "Weather Instruments." Listings include the name, address, phone and fax number of the vendor, plus a description of products or services. Also included are new, non-radio-related listings, such as environmental organization BBS's. The catalog also has the complete *Ham-Soft Shareware Catalog* included. The *Resource Directory* part contains a "Directory of 100+ Free Catalogs," a "Directory of Catalogs for a Fee," a "Directory of Radio Clubs," and much more.

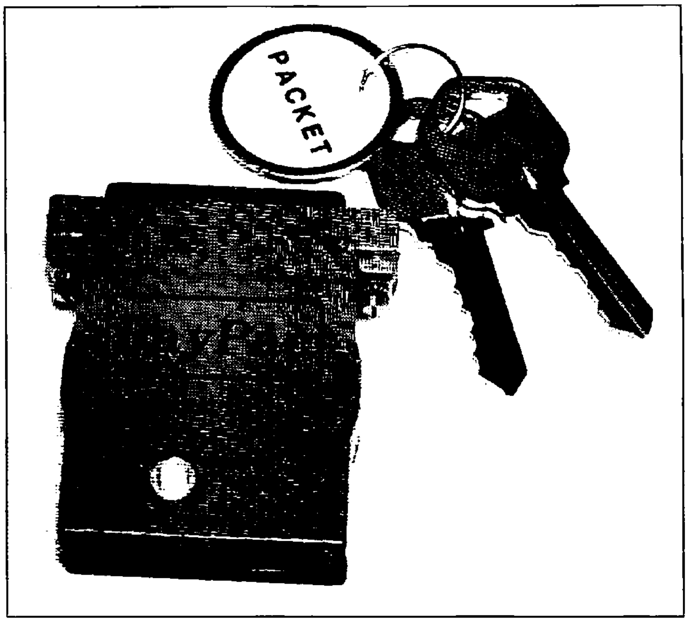
To maintain accurate listings, the catalog is updated and published twice a year. A two-issue subscription is $20 ppd. in the U.S., $25 ppd. foreign; the single issue price is $12. Contact *John Hart NØOCF, Hart Publishing, 767 South Xenon Court, Suite 117, Lakewood CO 80228; (303) 987-9442.* Or circle Reader Service No. 206.

INTERCONNECT SPECIALISTS



Interconnect Specialists has introduced a new line of DTMF microphones with features not found in any other microphones. All models feature optical push-to-talk switches for extreme reliability. The keyboards are back-lighted and use sealed snap dome switches by ITT rated at 100,000 operations. Tone and voice levels are externally adjustable. The TTM-9000 is a basic manually dialing model with automatic PTT. The TTM-9100 features continuous tone or burst mode dialing, a PTT timer, and PTT control of the monitor function. The TTM-9200 is a memory dialing microphone featuring single-button memory dialing. Other features are store and send, scratch pad memory, 10 user memories, two ANI memories, and automatic redial of the last manually dialed number.

For prices and more information, contact *Interconnect Specialists Inc., 474 Charlotte St., Longwood FL 32750; (407) 332-0533, (800) 633-3750, Fax: (407) 332-4912.* Or circle Reader Service No. 205.

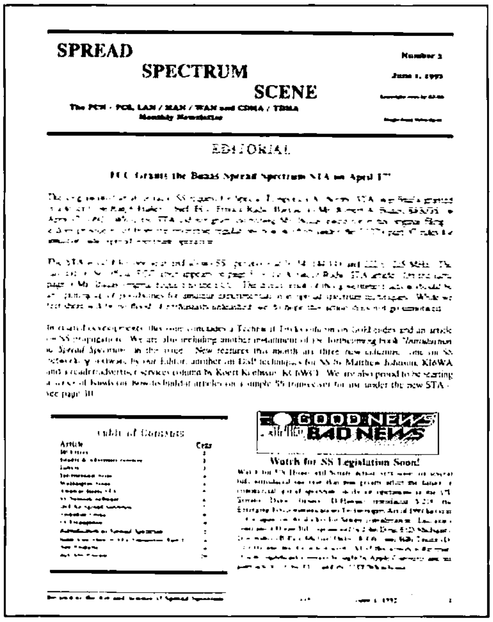


TIGERTRONICS

Tigertronics has announced a revolutionary breakthrough in packet technology with the new Model BP-1 Packet Modem. Specially designed to work with TNC emulation programs like BayCom and SofTnc, the BP-1 transforms an IBM compatible computer into a full-featured packet controller. Extremely easy to install, the BayPac simply connects between the computer's serial port and the radio with a small four-conductor cable. This radio cable features a "quick connect" plug, allowing the modem to be moved very quickly to other radios (base, mobile, hand-held). The Digital Signal Processor in the BP-1 is crystal-controlled, auto-calibrating, and never needs alignment.

Not much larger than a book of matches and weighing a scant 1.3 ounces, the unit requires no external power supply and sells for just $49.95. Contact *Tigertronics, Inc., 400 Daily Lane, P.O. Box 5210, Grants Pass OR 97527; (503) 474-6700, (800) 822-9722.* Or circle Reader Service No. 202.

SPREAD SPECTRUM SCENE



The *Spread Spectrum Scene* newsletter is published for the interchange of the latest news and information about the growth, regulation and opportunities in the evolving technology of spread spectrum. Covering PCN, PCS, LAN, MAN, WAN, CDMA and TDMA technologies, the newsletter is intended for the working professional as well as the experimenter, student and amateur radio operator. Monthly features include: International and Washington reports; a spread spectrum networking software column; a DSP column; a Technical Tricks column on hands-on spread spectrum techniques; antenna and propagation articles; serialization of a new book on spread spectrum and reader contributions on subjects relating to spread spectrum.

For the subscription price and more information, contact *Randy Roberts KC6YJY, RF/SS—Spread Spectrum Scene, P.O. Box 2199, El Granada CA 94018-2199; (415) 726-6235, (800) 524-9285, Fax: (415) 726-0118.* Or circle Reader Service No. 204.

73 INTERNATIONAL

Number 24 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

Just a couple of quick notes before we get to the international news. I received some additional information concerning language study books. Rodney Jackson WA9NZF has brought another source of books to our attention, in addition to that from David Cowhig WA1LBP.

"There is not only one book, but there are five books in print to assist U.S. (or English-speaking hams) with foreign QSOs. And yes, one of the books includes Japanese. In fact, it is the reason I purchased the book. The books are the brainchild of 'Rose,' the wife of a ham in Mundelein, Illinois. The books are advertised in 73 Magazine. 'Rose' now has four books in print. Each book covers four different languages in addition to English. For example, in Book 1 there is Spanish, German, French, Polish, and Japanese, plus English. Each language has 41 pages of QSO information covering antennas, openings, closings, colors, days of the week, greetings, hobbies/interests, locations, and others. Every language section is the same. For instance, on page 13, phrase number seven is 'My QTH is (2) km south of Chicago,' no matter what the language. Computer generation is wonderful for this!

"Book 2 covers Swedish, Italian, Portugese, Norwegian, and Serbo-Croation. Book 3 covers Russian, Danish, Czech, Korean, and Hawaiian. Another book covers Chinese, Dutch, Finnish, Romanian, and Vietnamese."

I found the ad for "Rose" in one of the issues and each volume costs $10 US (or $12.50 US for shipping outside the US) and can be ordered from Rose, P.O. Box 796, Mundelein IL 60060-0796. Tell them that Rodney and Wayne sent you. Rodney comments that the books are spiral-bound, lay flat, and are of excellent quality for the price. Rodney says, "Ga suki desu (I like it)."

I want to correct an unintentional error on my part. David Horsfall has brought this error to my attention. I have used the word "Transportation" in the past instead of the word "Transport" in the Australian portion of the column. Just to keep the record straight, the correct usage is "Department of Transport and Communications."

And now on to the news from around the world.—73, Arnie N1BAC

Roundup

Democratic People's Republic of Korea (Pyongyang, North Korea) Letter from Josef Zabavik OK1DTG, dated 28 April 1992: Dear Friends! I allow myself to write a few sentences to you. I am a faithful reader and would like to describe my attempts to propagate our sport during one year of my stay in North Korea.

Just after arriving in this country, in April 1991, I requested (in written form) a local licensing organization to give the official licence for radioamateur broadcasting activity. My request was delivered via the Post Office and then via Diplomatic Post (a diplomatic note). Because of the lack of a response until September 1991, I repeated my request six more times, from September 1991 to March 1992, but still no answer. My requests were also directed to the Korean People's Army (KPA) which is responsible for the communication services in the D.P.R. of Korea.

In April 1992, when I was about to finish my stay in this country, I received information from the staff of the KPA (from the Chief Protokol). I was told in principle that they didn't have anything against my radioamateur broadcasting activity in the 40 meter band with output power of 10 watts. I wanted to receive this information in written form but I was told that it would be given to me later.

On this basis I started my work on 12 April 1992 in the 7 MHz band using the callsign OK1DTG/P5 and worked until 24 April 1992 when I asked the KPA once more to give me their permission in written form. In the meantime the day of my departure from North Korea was coming very near and I still had no physical proof of my efforts to receive written permission to operate. Since I didn't want to endanger my callsign, OK1DTG, I stopped communicating after approximately 500 QSOs on 7 MHz.

I am sending a similar letter to the Amateur Radio Relay League and am asking them to recognize my efforts to receive official permission for my activity from North Korea.

It is hard to imagine how hard the living conditions are and that it is almost impossible to gain something and to have to urge the government to give you a final answer to a request. I think that this place will be inaccessible for our sport for a long time to come if this lack of communications continues.

Josef Zabavik, OK1DTG, UNCSF-JSA(JDO), Czechoslovak Delegation to the NNSC, APO AP 96 25/-0417, USA; or Ohradni 1361, 140 00 Praha 4, Czechoslovakia.

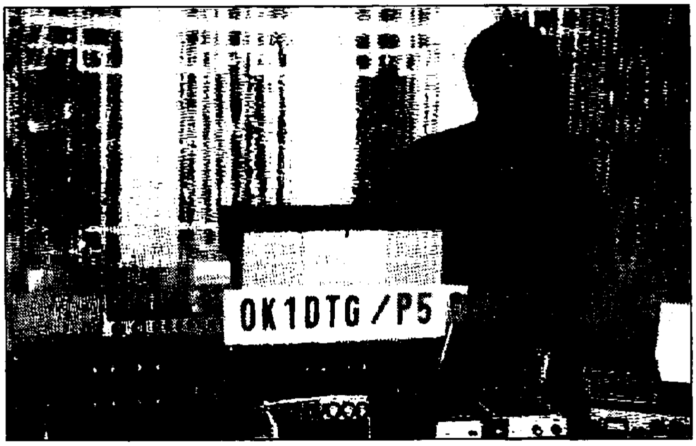


Photo A. Josef Zabavik OK1DTG/P5 and ham shack while in Pyongyang, D.P.R. of Korea (North Korea).

Japan (From the JARL News):

JARL & CRSA RELATIONS

Mr. Qin Duxun, President of the Chinese Radio Sports Association (CRSA), arrived in Japan on February 15th, accompanied by Mr. Wan Xun, Deputy Secretary-General. Upon visiting JARL's headquarters, they exchanged lively talks with President Hara JA1AN, and other staff members. With renewed determination, both sides discussed in earnest about promotion of friendly relations between their two countries through means of amateur radio and following an exchange of opinions, it was agreed that the ties of friendship already existing be further strengthened.

Scotland From "Paddy" McGill, GM3MTH: The Scottish Tourist Board (Radio Amateur) Expedition Group is listing two expeditions for August. The first will take place on August 1st from Pollok Park in Glasgow, home of the Burrell Collection and Pollok House, birthplace of The National Trust for Scotland, established in 1931. The callsign used will be GB8PP.

The second expedition will happen August 22-23 at the 3rd Annual West of Scotland Steam Fair at the Summerlee Museum in Coatbridge. The callsign will be GB6SM.

The normal times for the events are: Saturday—0800-2200 UTC and Sunday—0900-approx. 1500UTC. For a List of Events/Information Pack write to: John (Paddy) McGill, GM3MTH, 9, Ramsay Pl., Coatbridge, Lanarkshire, Scotland, ML5 5RE. Enclose two second class stamps or the equivalent for return postage.

Switzerland From the International Telecommunication Union (ITU) Press Release: Azerbaijan and Estonia became the 167th and 168th members of the ITU in April 1992.

Azerbaijan is situated on the south-eastern flanks of the Caucasus Mountains and is bordered by the Caspian Sea, the Islamic Republic of Iran, Russia, Armenia, and Georgia. It has a land area of about 86,600 square kilometers and a population of approximately 7,029,000, of which 1,757,000 is in the capital, Baku (1989).

Estonia is bounded west and north by the Baltic Sea, east by Russia, and south by Latvia. Its population size is 1,573,000 (1989) of which 482,000 live in the capital city of Tallinn. Its main economic activity is agriculture and dairy farming. Estonia has also rich high-quality shale deposits, peat deposits, and phosphorites. But the degree of expertise of its work force favours the development of light industry (textile, woodwork, radio equipment and electronics, and measuring equipment).

The accession of Azerbaijan and Estonia follow that of Lithuania (12 October 1991) and Latvia (11 November 1991). The former USSR Republics of Belarus and Ukraine have both been members of the ITU since 7 May 1947.

WORLD TELECOMMUNICATIONS ADVISORY COUNCIL

Senior representatives of the telecommunications industry have agreed to create a World Telecommunications Advisory Council (WTAC). The initiative was taken in response to a recommendation made by the High-Level Committee. The High-Level Committee was established by the ITU Plenipotentiary Conference to recommend structural reforms to respond better to the changing nature of the telecommunications environment, and particularly, to respond to the challenge posed by the greater dynamism, creativity and competitivity of a number of new partners.

The Council aims at providing the ITU with strategic advice from the public and private sectors on the telecommunications environment and how, in the light of its dynamic nature, the Union's principal activities could be carried out more effectively.

Its purpose is also to consider the state of global telecommunications network and services, monitor its growth and make recommendations for the promotion of the harmonious worldwide development of information technology, for the well-being and betterment of mankind. In addition, the Council will work to raise awareness among financing institutions and governments in developing countries of the importance of investing in telecommunications.

Further information can be obtained from: Mr. Terrefe Ras-Work, Executive Secretary of WTAC, International Telecommunication Union, Place de Nations, CH-1211 Geneve 20, Switzerland.

Ukraine From the Prometheus Ham Digest (PHD) of the Prometheus Amateur Association (PAA): The front page article of the Digest is an Open Letter to Mr. V.I. Delikatny, Minister of Communications of the Ukraine from V. Kiyanitsa, Executive Secretary, RSF of the Ukraine. The topic addressed the problem of letters being sent to Ukraine hams by foreign hams being opened, contents being removed, and sometimes the remains being sent on or "lost."

V. Kiyanitsa ran an experiment hav-

ing 27 letters mailed to him from abroad with one to two IRCs enclosed. Only three letters made it to him!!! "I only hope that you, Sir, will investigate the problem thoroughly and will be able to stop what is going on since it influences the international prestige of the Ukraine."

[For those of you who have not received QSL confirmation from Ukraine hams, or even those in other countries, this may be the reason. Don't blame the hams themselves unless you have positive proof! At least one country is attempting to correct the problem.

PHD has been published by PAA since August 1991. One-year subscriptions are available for US$12 from PAA, c/o George Yankopolus, 13 Glen Meadow Drive, Glen Mills PA 19342, USA. Letters, pictures, articles, etc., should be submitted directly to the Editor, Alex Ulyanich RB5IJ, Box 1, Enakiewo 29, Konetskaya Oblast, 343820 Ukraine.—Amie]

AUSTRALIA

David I. Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

There is not much news at the moment that has not been covered before—the "Code-less Novice" is still on its way, the "CW Forever" brigade are still fighting a rear-guard action, and the ROSE/NetRom protocol wars continue unabated, with various personality clashes and claims of theft and vandalism of packet switches.

The Department of Transport and Communications (DoTC) has released an information paper—RIP-73A—which provides information for overseas operators and covers reciprocal licences and temporary permits. It is worthwhile reproducing the highlights here. Overseas amateurs visiting Australia fall Into three categories:

CATEGORY A: Amateurs from countries having a reciprocal licensing agreement with Australia. These countries are: Canada, Denmark, France (and New Caledonia), Germany, India, Israel, Japan, Malaysia, New Zealand, Papua New Guinea, Poland, Singapore, Solomon Islands, Spain, Switzerland, United Kingdom, and United States of America. Amateurs visiting for less than a year will be issued with a temporary non-renewable permit. Amateurs intending to stay will be issued an Australian amateur licence.

CATEGORY B: Amateurs from countries having no reciprocal licensing agreement with Australia but having qualifications/licences with a recognised Australian equivalent. These countries are: Argentina, Falkland Islands, Greece, Hong Kong, Indonesia, Ireland, Italy, Luxembourg, Malta, Nauru, Netherlands, Norway, Philippines, South Africa, Sri Lanka (Ceylon), Sweden, Vanuatu, and West Indies (Cayman Islands). Amateurs from these countries, regardless of their residential status, will be issued a non-renewable temporary permit for 12 months.

CATEGORY C: Amateurs from countries having no reciprocal licensing agreement with Australia and no recognised Australian equivalent qualifications/licences. Amateurs from these countries, regardless of their intended residential status, will be issued with a non-renewable temporary permit for 12 months, permitting 10 watts (mean power) FM telephony in the 146-148 MHz band only [this looks suspiciously like the proposed Code-less Novice licence!].

It is preferable that you apply for a licence in person so that the original documents can be sighted and a licence issued over the counter. Applications are accepted by mail, but please allow three months so that the licence can be forwarded to you before you depart for Australia. The following documents are needed: (a) a copy of your amateur certificate and passport (with English translation), certified by a public notary (mail applications only); (b) a completed licence application form (RF-57); (c) your current licence, or a certified copy, with English translation; (d) proof, such as a visa, that your visit is for no longer than 12 months (visitors only); and (e) the current licence fee of $35 (Australian). Cheques or money orders are to be payable to the "Receiver of Public Money."

Note that whilst licences are renewable annually, temporary permits are not. If you are granted an Australian licence or permit as a visitor, it cannot be used to obtain a licence in other countries. Also, Australian operating conditions, e.g. power levels, etc., must be adhered to. Finally, an Australian licence, temporary permit or callsign can only be used with Australia, its territories, or territorial waters. Further information can be obtained from the Department of Transport and Communications in each state, or from the Wireless Institute of Australia, P.O. Box 300, Caulfield South, Victoria 3182, Australia.

This was longer than I intended, so in the next column I'll briefly summarize the Australian licensing scheme, the power levels and modes, etc., and how to tell an operator's grade of licence from his/her callsign. Cheers for now. Those with access to Internet or packet can contact me as "dave@ips.OZ.AU" and "VK2KFU@VK2RWI.NSW.AUS.OC" respectively. 73, Dave VK2KFU.

BULGARIA

Milen Postadshieff
PO Box 237
7000 Russe
Bulgaria
Packet: LZ2MP@HB9AK.CHE.EU or LZ2MP@DKIØMTV.DEU.EU

DIGITAL MODES IN BULGARIA

The first serious RTTY activity in Bulgaria started around 1974 at the student radio club LZ1KDP in Sofia, the capital city of Bulgaria. They were using a mechanical RTTY machine donated by the German Amateur Radio Teleprinter Group (GARTG). Until 1986 some other stations were active on RTTY from Bulgaria, but two stations stood out as the most prominent: LZ1KDP and LZ2KRR.

In January 1986 LZ2MP and LZ2XA activated the Student Radio Club

LZ2KIM at the Technical University in Russe on RTTY using an Apple II+ compatible computer, a home-brew T.U. with active filters, and a simple RTTY program. This proved to be the first "computerized" RTTY station in Bulgaria. In May 1986, using the RTTY setup and a Hamtext program from Kantronics, LZ2MP activated the club station LZ2KIM on AMTOR, which was also a first for LZ land. Finally, in March 1987, running a home-brew 300 baud modem and a DL2MDL AX.25 program, LZ2KIM was activated on HF Packet. Again, this was the first packet activity from Bulgaria.

Today there are about 20 RTTY setups in Bulgaria but quite often hams who do not have RTTY capabilities at home use the club equipment under their own callsigns. Consequently, you may have heard many more LZ stations on the air. Most of these stations typically consist of a home-brew Apple II compatible and T.U. with active filters.

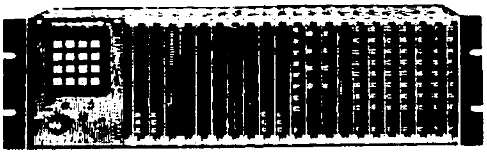
On AMTOR there are about five stations currently active. For this mode most of the hams are using Apple II, home-brew T.U. with active filters, the HB9BCS AMTOR/RTTY program or a home-brew AMT-1 look-alike unit.

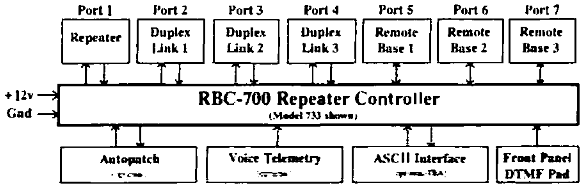
About 15 packet radio set-ups are in use here. We don't have any VHF/UHF packet networks here because of the lack of equipment, so most of the activity is on HF or on direct links within the same QTH. A typical packet set-up consists of an Apple II compatible, a home-brew modem with the DL2MDL AX.25 program or home-brew TNC2 look-alike unit.

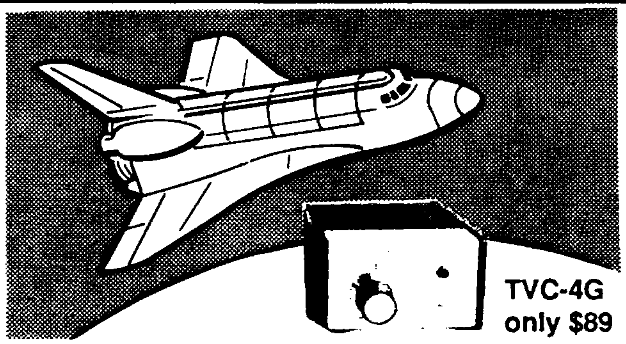
It is not too difficult to build a home-brew Apple II look-alike here, and lately even factory-built ones are available at a reasonable price. IBM PC/XT compatibles are also available lately but they are extremely expensive, so the digital activity is increasing very rapidly.

With the political changes during the past few years some surplus military and police equipment that can be modified to 2m FM has become available but it is not very easy to get and can be a bit expensive. Last year the first three 2m FM repeaters were installed. Two of them are high in the mountains and are accessible from almost all locations in Bulgaria. There are approximately 200 hams who have equipment for 2m FM, most of it crystal-controlled. We hope that by the end of this year there will be several packet digipeaters and even packet nodes installed in Russe, Sofia, and some other places, so probably within a few years more activity will take place. The countries around Bulgaria are not connected to the European Packet Net but we have high hopes for the future, maybe even an HF APLINK system from here to connect to the rest of the country and the world. Initial experiments are in progress at LZ2MP and LZ2KIM. Watch out world, here we come!

73, Milen LZ2MP.







Continued from page 4

attitudes? Well, we can start by admitting that punishment has never worked as a good teacher. Yes, these crummy people have robbed, beaten, raped and so on. They certainly deserve to be punished, right? So let's teach them a lesson by locking them up for a few years and making life rotten for them. Let's get even.

Well, that may be satisfying to the victims, but we know now that the whole process only makes things worse—resulting in even more victims. And knowing how lousy prison is, plus having had a master's education in crime while in the joint the last time, they're even more nasty to their new victims and harder to catch. So should we molly-coddle them instead? Then we come off as suckers and they were right to take advantage of us.

Okay, here's my proposed solution to the prison problem. First, in order to get costs down I propose two approaches. One is to put prisons where it's less expensive to keep people. Let's start looking for contracts from private prison companies with facilities in the low-rent areas of the world. It's obviously a lot less expensive to store people in tropical third-world countries than in Massachusetts—even counting the transportation. If I were going into the prison business I'd check out Chad, Burkina Faso, Guam, Indonesia, Mexico, and perhaps even China. I think some of these places would make it possible to keep prisoners for a tenth the cost in the U.S.

With modern electronics it's easy to keep track of prisoners by putting a small neck transmitter unit on them which will sound an alarm if they go beyond their allowed area. That saves on building walls, cells and guards. We can even add a microphone and record what they're saying and hearing. A nearby recorder can store months of voice-quality digital audio recording. Hey, we didn't guarantee them privacy.

Now there's the little matter of reforming their behavior. We know that punishment just doesn't work, so let's think in terms of rewards for good behavior. For instance, the normal prison chow could be very basic slop—enough to keep them from starving, but still slop. To get better food they'd be permitted to work in co-op gardens and grow meat, fruit and vegetables. They get to eat better if they work. That's positive reinforcement for the old work ethic.

As a prison company I'd solicit bids from companies interested in setting up some plants to use my prison labor. A study of the raw materials available and the markets within easy shipping distance would result in a list of products which could be made at a profit. Forced labor? Nah. Again, the prisoners would have the choice of a bare minimum existence or else working and earning credits which could be used to rent a TV, video cassettes, audio cassettes, a boom box, nice furniture, and other comforts. They'd be learning skills which will help them rejoin society and get work when they're released.

Knowing that they're being recorded 24 hours a day and that authorities can at any time review the tapes might keep down antisocial behavior. Computers can even keep track of when any two or more prisoners are together, but not talking—suggesting they may be plotting something by writing instead of talking.

The prison-run businesses should be able to cover the costs of running the prisons, even turning a small profit. That's a lot better than socking taxpayers $25,000 and up a year to store more and more criminals. We might even want to charge them for the police and court costs of catching and convicting them, letting them work off those costs with part of their prison earnings. That would lower the taxpayer burden even further.

And, after all, it was their decision to break the law, which caused us the expense, so why should we have to foot the bill for catching and convicting them?

If they do commit more crimes when they get back and get convicted again, let's hope the judges make their prison terms much longer. After all, sending them away for re-education isn't costing us anything. For that matter, we might stop paroling really serious offenders since life in prison wouldn't be the misery it is now.

This system is aimed at trying to overcome the poor education we've forced on the poor. It isn't going to be as helpful to the worst criminal cases. But we can still store these crumbs in much less expensive areas of the world, fencing them in with an electronic bracelet with stun power if they get out of line or try to escape.

Between a good preschool education which will inculcate positive role models, a spirit of cooperation and an interest in learning, followed by cooperative education private schools, paid for via vouchers from the state, we can break the whole poverty system so we don't end up with street gangs substituting for failed families. Kids need to feel they belong to a group, so if the family is kaput, they depend on the gang.

The nice part of all this is that we'll be able to get rid of welfare, chronic unemployment, police and court costs, and prison costs, plus we'll be able to cut our educational costs by about 50% and still end up with better schools, complete with computers and satellite communications for distance learning courses. And the kids will be learning skills, plus how to be successful in the information age—successful in their work and life.

The past immigrants from Germany, England, Poland, Ireland, Italy and so on all proved our melting pot system worked. Within two generations their kids were Americans and spoke American. Now let's convince the blacks to stop being Afro-Americans and refusing to speak our language. And let's get the Hispanics to stop being Latin Americans and speaking Spanish. Let's aim at all being Americans and speaking American.

Once we get kids starting their education right from year one we'll be turning out a whole new generation of high-tech-enthused kids—and we'll have young hams by the millions—plus young computer hackers, and so on.

What Are You Going to Do?

If you agree that the above plan will work, will you do anything about it—or will you nod and hope someone else will do something? As a product of our school system where you've been trained since day one not to cause trouble, where you were squashed by teacher intimidation and humiliation, I can understand why it might be difficult for you to actually do something—like write to your two senators and your representatives, maybe sending them a copy of my plan.

How about your state senators and legislators—know any of them?

If there are any of my ideas that you disagree with or don't think will work, drop me a line. The above is a very abbreviated description of my plan, so I've had to leave out all of my references and extended explanations. I'd list a bibliography, but I doubt many of you will want to go to the expense and time to get and read so many books. I must admit that few of my educational plans are original—most have been tested and found to work superbly—some in hundreds of schools.

Now, if we can get rid of poverty, inner city gangs, crime and drugs, about all we'll have to worry about is health care and the national debt. I'll start working on those next week.

Exporting Jobs

More and more unskilled and low-skilled jobs are being exported to lower-wage countries. The displaced American workers are all upset and are pushing us to "buy American." Where this means buying lower-quality products for higher prices, this is not entirely realistic. As world transportation costs drop and world communication systems improve, more and more low-skill jobs are going to move to low-wage countries.

So what do we tell the $12 an hour automobile worker who's been replaced by a Mexican who's working for $1 an hour? He's mad! Here he's been doing his job, obeying the union rules for the last 20 years, and suddenly the plant is closing.

One answer is not what the angry unemployed worker wants to hear. We might ask him how much of his spare time he's spent in educating himself vs. how much he's spent bowling, watching TV, drinking with his buddies in the neighborhood bar, buying RVs, going on vacations, and so on? Has he been loafing for 20 years and now is suddenly faced with having to pay for that wasting of his life? How much should the government be responsible for bailing out people who have made no effort to protect themselves against changes the future might bring? When the automobile came along was it the government's responsibility to save the buggy whip manufacturers and their employees?

If instead of wasting all of their spare time the angry displaced workers had invested even a small amount of their time in building other skills, the moving of their jobs to Mexico or China would be an inconvenience, not a disaster. Could they have taken a mail order course in accounting, real estate, telemarketing, selling, refrigerator repair, electronics, and developed alternative skills? Could they have invested some time in a hobby with potential business applications? Amateur radio, besides being fun and a relatively inexpensive hobby, also can lead to employment in repairing consumer electronics, computers, security sales and service, facsimile, paging, radio broadcasting, and so on.

Learning to play an instrument can provide not just a safety net job, but also provide a fun spare-time income. Learning to write means developing another skill which is in desperately short supply—one which provides many opportunities for spare-time earnings. This can easily lead to making money with desktop-publishing-produced newsletters.

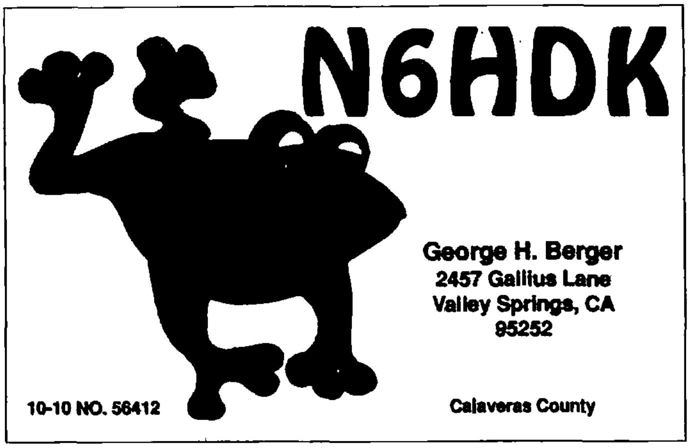
One has to be almost blind not to see what's happening. The low-skill manufacturing jobs are moving to low-wage countries. More and more of them are going to go, leaving bewildered low-skill, high-wage workers behind demanding that the government *do* something. Senator Kennedy will introduce bills to stop this carnage and to force manufacturers to pay higher wages for poorer work. President Bush will "understand the pain" these displaced workers are suffering.

Worse, as more immigrants arrive, willing to work for almost anything in order to get started, even low-skill service jobs are going to be taken away from middle-class Americans and taken over by people willing to work for less. And I don't see any sign of our building a Great Wall across our Mexican border, so we're going to have plenty of immigrants for a long time to come.

How About The Unions?

Union membership has been dwindling for many years. Their ability to protect low-skill, high-pay jobs is being blown away by foreign competition. Unions were needed in the late 19th and early 20th centuries, when some manufacturers took terrible advantage of workers. But, having watched the printing and stagehand unions at work close up, the cure has turned out to be as bad as the disease in some instances.

When I worked at WPIX in New York as a cameraman, I watched the stagehands drawing amazing salaries



QSL of the Month

To enter your QSL, mail it in an envelope to *73*, Wayne Green Inc., 70 Rte. 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

for completely unskilled work. Their union was closed, allowing few but the sons of union members to join. They had a closed shop with every theater in town, plus the TV stations. So there I was, a skilled engineer and cameraman, making one-fourth the stagehand wages.

When I started publishing *73* in 1960 I had it printed by a union printer—which was all there was available. I watched 40-year veteran printers who were drawing as much as those stagehands and unable to specify type to fit into an ad. They'd have the type set over and over until it finally fit. There was no way to fire these dummies, so the printing company eventually built a new plant in Connecticut and closed their Manhattan plant, mainly to get rid of them.

I watched one New York newspaper after another being put out of business by union strikes. The unions fought every cost-cutting effort by the papers. When Varityper came along with a faster and less expensive way to set type the unions refused to let newspapers use it. If you're not familiar with the railroad union battles to preserve featherbedding, you need to read some history.

The *Reader's Digest* has printed endless stories of union viciousness during strikes. Killing people, destroying buildings, cars, buses and trucks. The chap living next door to me when I was a kid had had both of his legs broken by the union, crippling him for life. He'd been a ship's captain and, under orders from the shipping line, tried to hire scabs when the union struck the line.

The automobile unions have to share in the responsibility for the loss of so *much of our car industry.* Their semiskilled workers were making over double the average American wage—in addition to turning out shoddy cars—making it easy for the Japanese to compete. Yes, the Detroit car execs share in the blame for what happened, with their lack of foresight and lousy planning.

With today's worker mobility, and the export of low-skilled jobs, it may be time to reconsider the role unions should be playing. Just as we're seeing the weakness of the adversarial approach to business and government relations, perhaps we should consider some way for unions, management and government all to work toward a cooperative consensus which will help make America more competitive.

In the meanwhile it might be helpful for a few *million* low-skill American workers to be encouraged to come to grips with the way the world is changing and understand the importance of building alternative skills and interests. There's never going to be a big market for people with great memories for baseball statistics or positions open for soap opera watching. Watching most TV, sports and games is a way of getting through life without having to think or do anything. These fight off the boredom of just sitting around. The rewards are so meager as to be worthless. Ditto 99% of news watching and, at least in my perspective, reading newspapers.

What should we be doing with our time? If we think in terms of developing marketable skills we won't go far wrong. And if we can tie these into a hobby, all the better. Computer programming, for those involved, is exciting fun. It's incredibly exacting, which is part of the fun. Photography makes a great hobby—plus it offers plenty of opportunities for making money. Many hobbies can be escalated into small businesses. We've got hundreds of ham radio operators who've started their own businesses and are doing fine. They're not really entrepreneurs, they're more interested in having their own business and not having to work for someone else.

I tend to encourage people to get into desktop publishing with a Macintosh system since it's relatively inexpensive and easy to learn to use. There are needs for so many publications that I doubt a week goes by that I don't come up with a niche that desperately needs filling. I'd love to start a new magazine a month—if I could find people with the skills to turn 'em out. I've got plans for one in the construction industry, one in the vacation business, a couple in education, a couple political, two for the video industry, and so on. So where do I find people who've skills in selling, writing, editing, photography, advertising, promotion, mail order, and so on?

Making The Time

Changing habit patterns is difficult. Ask any fat person who's tried to diet—and they all have—and they've all failed, elst they wouldn't still be fat. Habits are tough to break—particularly bad habits. And this obviously holds for *the habits preventing people from* developing skills and building knowledge. Our educational system has exacerbated this problem by rewarding us quickly for small achievements. This has resulted in a generation (or two) of Americans who find it difficult to concentrate on long-term goals. Getting thin, no matter what headlines you see in the supermarket tabloids, takes a long-term commitment. So the more determined dieters take off a few pounds and then quickly bloat up again. The less determined don't make it past the nearest ice cream store.

Just imagine how much time you'd have if you didn't waste it with activities which have no long-range benefits for you. Gone would be the six-packs. Gone would be the ball games. Gone would be sitcoms. Gone would be soaps. Gone would be a lot of idle chitchat. Gone would be 98% of the movies. Gone would be a lot of pop music, pop books, and pop magazines such as *People* and *Self*. If you cut out your wasted time, how much would you have available to build your skills? How much could you devote to your kids and their education? How much to your marriage? How much even to building your career? Could you spend some time teaching? We are in desperate need of elmers to help prospective hams learn about electronics and amateur radio. Of course, if you only memorized the answers to get your ticket, you're not going to be much of an elmer.

First, let me explain that from your letters and talking with you on the air, I know that 90% of you are painfully uneducated in electronics and radio theory. I've offered many times to increase the number of technical articles in *73*, with virtually no positive response. When I ask for a show of hands during my hamfest talks I find that hardly any hams understand how digital communications works—or packet—or even satellite.

Yes, I know, amateur radio is a hobby, so why bother learning anything *more than where the* mike jack and antenna terminals are located on your rig? You're busy being a lawyer, doctor, truck driver or whatever and don't have time to become an electronic engineer. But what happened to your spirit of adventure? Did your parents fail to help you learn the excitement of exploring new ideas? It's tremendous fun to get involved with slow-scan or 2 meter SSB DXing. It's fun to get involved with RTTY and get together with other RTTYers. I still get letters from the RTTY friends I made back in 1949—even from one now living in V85, if you know where that is.

Computers are terribly complex, but it doesn't take a genius to cope with them and learn how they work, right on down to the microprocessor chips. Like successful dieting, all it takes to get way ahead of 99% of the people in understanding and working with computers is the determination to actually do it.

Can we get across to the low-skill workers the precariousness of their jobs? Can we get them involved in activities which will bail them out when the future finally catches up with them? If amateur radio seems too complicated for them, they might take up woodworking, metalworking or some other craft which will build a marketable skill. If they can learn to fix VCRs their future will be very secure. I've got a stack of 'em they can start with. But you know, though we like to posture and brag in front of people about our technical hobby, we all know that getting a ham ticket depends more on persistence than brilliance. We've all heard some of the licensed dummies we've got braying on the air—we just prefer not to let the world know about 'em. Thank heavens they're few in number, so we just give them a wide berth when we hear them.

Anyway, the next time you see a news program with out-of-work people railing against our buying foreign-made products and putting them out of work, just think a little about their stupidity in not seeing this coming and planning for it. Our exports are getting close to our imports in volume, so we have no legitimate complaint about imports. Our efforts to limit imports are a disaster. We're paying almost $250,000 for every automotive job we've saved by limiting Japanese car imports. Phooey.

Teapot Tempests

The ham newsletters have been scraping the barrel lately. Like f'rinstance the FCC, which has been refusing to issue special calls, got forced by the USIA into issuing one for the VOA's 50th anniversary: K3VOA. Sigh. And a judge awarded N5DA $10,000 from N5EWD for some names he was called over the local repeater. Oh yes, the West Coast IARN director quit after an abusive call from Baxter. And WA6ITF is pissed at Baxter for messing with his news reports. An average week.

With KV4FZ presumably QRT after his court conviction, I wonder how the mess he generated on 14.313 is progressing. I suppose there's no real hope of getting Congress to grant a special exemption from prosecution for blowing away the rest of the BARF gang. It's the lack of reasonable loopholes in our laws that are making the Mafia so successful. If we could attract some Sicilian hams, perhaps we could get our bands cleaned up. Lord knows the ARRL seems to have absolutely no interest whatever in the problem. 73

Number 26 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events*** *in message* ***Area #11*** *on our* ***BBS (603-924-9343)****, for listings that were too late to get into publication.*

ANNOUNCEMENTS

PROVIDENCE, RI The NN 1 U Testing Group will conduct VE Exams every 2nd Thursday of the month at 7 PM at the American Red Cross Bldg., 150 Waterman Ave., Providence RI. Walk-ins. Bring a picture ID and one other ID, your license and copy, same for CSCE that you need to upgrade and a copy of Form 610 submitted for Novice license. NN 1 U Testing Group will administer the test to handicapped persons, in their home, within 30 miles of Providence. If necessary, contact ***Judy KC1RI, (401) 231-9156.***

BOULDER, CO The Boulder VE Team will conduct VE Exams the 2nd Monday of most months at St. Mary Magdalene Episcopal Church, Heatherwood Dr. and Cambridge St., Boulder CO. Please bring a picture ID and one other ID; a check or money order payable to "ARRL-VEC" for $5.40; the original of your current license, if any; originals of applicable Certificates of Successful Completion of an Examination if you claim credit for any test elements; a copy of the FCC 610 you submitted if you claim credit for a Novice license not yet received; soft pencils and a calculator. For info, and to pre-register, call ***Barbara McClune NØBWS, (303) 530-2903.*** Pre-registration is preferred, but walk-ins are welcome.

AUG 2

SUGAR GROVE, IL The Fox River Radio League's 1992 Hamfest will be held at Waubonsee Community College, Rt. 47 at Harter Rd., Sugar Grove IL (5 miles NW of Aurora), starting at 8 AM. Set-up Sat. after 7 PM and Sun. 6 AM-8 AM. Flea Market. VEC Exams at 10 AM. You must bring your original FCC license, a copy of your FCC license, and a photo ID. Advance tickets $4/3 stubs; at the gate $5/1 stub. Indoor tables $10/8'. Free parking. Camp grounds nearby. Free Tailgate spaces. Talk-in on 145.470 - 600 W9CEQ. Commercial vendors please call ***(708) 584-1806*** for info. Advance registration deadline is July 15th.

Randolph, OH The Portage ARC, Inc., (ARRL affiliated) will sponsor its 7th annual Hamfair at the Portage County Fairgrounds, just off Interstate 76 between Akron and Youngstown. Gates will be open from 8 AM-4 PM. Advance tickets $3, $5 at the gate. Children under 12 free. Flea Market $3 per space. Indoor tables $8 ea. Computer hobbyists welcome. Talk-in on 145.39 (negative offset). Contact ***Joanne Solak KJ3O/8, Portage ARC, Inc., 9971 Diagonal Rd., Mantua OH 44255. Tel. (216) 274-8240.***

ESCANABA, MI The Upper Peninsula Hamfest/Computer Show, sponsored by The Delta County ARS Inc., will be held from 9 AM-6 PM EDST at the Escanaba Area High-School. The Delta County Tourism & Convention Bureau, Elks Lodge, and Delta County Chamber of Commerce, are co-hosting this event. ARRL sanctioned. Packet, ATV, model airplane demos. Set-ups 6 AM-9 AM. Provide your own power cords, lighting equip., and literature. Each vendor will be expected to donate prizes for the hall-hourly raffle from 9 AM-4 PM. The show will provide tables, chairs and benches, electrical outlets (first come, first serve). There is an application fee of $50 per vendor per entry. Tables $6 ea. Outside Flea Marekt $6 per auto-sized space. For info contact ***Hamfest Committee, D.C.A.R.S., PO Box 923, Escanaba MI 49829.***

AUG 8

HUNTINGTON, WV The Tri-State ARA, Inc. VE Team will sponsor VE Exams starting at 10 AM at Our Lady of Fatima church school class rooms, located at 545 Norway Ave., Huntington WV. All test sessions will be W5YI testing sessions. **(This date and location is tentative, please call for confirmation.)** Candidates for new or upgrade licenses should bring a photo ID, copy of current license or original CSCE, and a completed Form 610 (Form 610 will be available at the test session). Walk-ins OK. Arrange to arrive by 9:15 AM in order to register and have ID and Form 610 checked prior to examination. For info contact **Jim Baker K8KVX, (304) 736-6542.**

BEND, OR The Central Oregon Radio Amateurs will hold their 3rd Annual Hamfair at Sunrise Village at Mt. Bachelor, SW of Bend, from 9 AM-4 PM. Free secured overnight parking for self contained RVs. VE Exams from 9 AM-Noon, pre-registration only. Send FCC Form 610, a copy of current license if applicable, and a check for $5.40 payable to ARRL/VEC to: **CORA, PO Box 723, Bend OR 97709.** Deadline is July 15th. Flea Market. Presentations. Seminars. Advance tickets $5 by July 15th; $7 at the door. Tables $10. Tailgate $2. For tickets/info, contact **Don Harrington N7ION, 69706 W. Parkway Meadow, Sisters OR 97759. Tel. (503) 549-7951.**

AUG 9

PEOTONE, IL The Hamfesters RC. Inc., will sponsor their 58th Annual Hamfest/Computer Festival at the Will County Fairgrounds from 6 AM-3:00 PM (exhibits open at 8 AM). Set-up Aug. 8th from 6 PM-Midnight. Commercial exhibitors welcome. Reservations close July 20, 1992. Electricity available outside the Exhibit bldg.; $10 plug-in fee by Fairground. Donation $4 advance, $5 at the gate; under 12 years free. Talk-in on 146.64- STARS and 146.94- KARS. For reservations send SASE and check to ***David F. Brasel NF9N, 7528 W. 109th Place, Worth IL 60482. Tel. (708) 448-9432.***

FRANKFORT, KY The ARRL Central Kentucky Hamfest, co-sponsored by the Bluegrass ARS, Inc., and the Capital ARC, will be held from 8 AM-4 PM at Western Hills High School, Exit 53 off I-64, Frankfort KY. License Exams, technical forums, commercial exhibits, are in air conditioned facilities. Outside Flea Market space, free with paid admission, for each person over 12 years of age. Tickets $5 in advance, $6 at the gate. Tables in commercial vendors area are $15 each if prepaid before July 15th, $25 each after July 15th. For info, tickets, SASE to ***Bobby Rolph KB4QNR, 2117 Winterberry Rd., Lexington KY 40504*** or call ***(606) 278-7570 eves.***

AUG 15

AMARILLO, TX The Panhandle ARC will hold their annual Golden Spread Hamfest at the Amarillo Civic Center, 400 S. Buchanan (in downtown Amarillo) on Aug. 15th. Handicapped accessible. VE Exams. Advance tickets $6, $7 at the door. Tables are $5. Call ***Leland Carpenter N5VRN, (806) 352-8759***, or write to ***Golden Spread Hamfest, PO Box 1524, Amarillo TX 79105-1524.***

AUG 15-16

ALBUQUERQUE, NM The Duke City Hamfest will hold an Event at New Mexico National Guard Armory, 600 Wyoming NE, Albuquerque NM. To get there, take the I-40 South Wyoming exit; the Armory is 3 blocks on the left. Swap Meet. Technical classes. VE Exams. For more info, write to ***Duke City Hamfest, PO Box 6552, Albuquerque NM 87197.***

HUNTSVILLE, AL The 1992 Huntsville Hamfest will be held at the Von Braun Civic Center in downtown Huntsville. Doors will open both days at 9 AM. Activities will all be held under one roof in air-conditioned facilities. Dealer Show. Flea Market. Technical forums. NASA Space Exhibits. Ladies' and childrens' activities. Evening banquets for the entire family. Adult admission is $5 for both days; children admitted free. Talk-in by K4BFT ("Big Fat Turkey") on 146.34/.94. Call ***(205) 860-8004*** or FAX ***(205) 534-5557*** for more info.

AUG 16

CAMBRIDGE, MA The MIT Radio Society, and the Harvard Wireless Club, will hold a Flea Market from 9 AM-2 PM at Albany and Main St., Cambridge MA. Admission $2. Free off-street parking. Covered tailgate area. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. For reservations and more info, call ***(617) 253-3776.*** Mail advance reservations before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 & 449.725/444.725 pi 2A - W1XM rptr.

LAFAYETTE, IN Tippecanoe ARA will hold the 21st annual Lafayette Hamfest at the Tippecanoe County Fairgrounds, 18th and Teal Rd. (Ind 25 South). Gates open at 1100Z. Setup Sat. 5 PM-8:30 PM. No rental tables available. Admission $4, at the gate only. VE Exams. Activities for XYLs and children. Talk-in on 146.730/.52. Contact ***Bruce Stewart N9GKE, 315 Hamilton St., West Lafayette IN 47906. Tel. (317) 463-2379.***

GEORGETOWN, DE The Sussex ARA will sponsor the Original Delmarva Hamfest at the Delaware Technical and Community College, starting at 8 AM. VE Exams. Tailgating. CW Contest, and more. Contact ***Bruce Palmer KD3WL, (302)-539-0781*** or ***Bill Hammond N3IOD, (302) 539-5780.*** Talk-in on 147.075+, 224.840.

QUINCY, IL The Western Illinois ARC will sponsor the 7th Annual Tri-States Swapfest at Eagles Alps Lodge, 3737 N. 5th St. from 8 AM-2 PM. Outdoor tailgate area. Indoor vendor tables. ARRL VEC Exams. ARRL table. XYL activities. Advance tickets $2.50, $3 at the door. Talk-in on 146.63/.03, 146.34/.94. Contact ***Jim Funk N9JF, c/o WIARC, PO Box 3132, Quincy IL 62305-3132. Tel. (217 336-4191.***

AUG 20-23

LOS ANGELES, CA The Los Angeles Area Council of Amateur Radio Clubs, and the Orange County Council of Amateur Radio Organizations, will sponsor the ARRL National Convention at the Los Angeles Airport Marriott Hotel. Exhibit hours are: Fri. 6 PM-9 PM; Sat. 9 AM-5 PM; and Sun. 9 AM-1 PM. There will be an Industry Reception on Thurs. Fri. events include an ARRL Educational Workshop and Hospitality Suites. Sat.: Breakfast $12, Swap Tables, Alternative Programs, VE Exams, Luncheon $15, Banquet $30, Wouff Hong. Sun. events: Breakfast $12. Auction, T-Hunt; make checks payable to ***HAMCON Inc., PO Box 570756, Tarzana CA 91356.*** There will be ARRL & FCC Forums, antenna and RFI seminars, DX and contest forums, T-Hunting, ATV, etc. Make your room reservations with the LAX Marriott at ***1-800-228-9290***, (be

sure to mention "HAMCON 92"). There are special discount travel fares available from Corona Travel Service, Inc. (the official Convention travel agency); Californians contact ***Mark W. Costa KB6GNZ, PO Box 2100, Corona CA 91718. Tel. (714) 737-7000***—outside CA call ***1-800-322-CORP***. Pre-registration before Aug. 1, $12; after Aug 1, $15. 16-year-olds and under, admitted free.

AUG 23

SAGINAW, MI The Saginaw Valley ARA will sponsor a Ham Radio Swap and Computer Fair at the Saginaw Civic Center starting at 8 AM. Set-up at 6 AM. The Swap will be located west of I-75, two miles along the I-675 Bypass. From Exit 2, follow the signs to the civic center. Advance tickets $2, $3 at the door. Advance tables $10, $15 at the door. Send payments with SASE to ***SVARA Swap Committee, PO Box 1783, Saginaw MI 48605-1783.*** Admission is *NOT* included with purchase of tables. Unpaid Reserved Tables will be resold at 9 AM. For info call ***(517) 781-3724***. Talk-in on 147.240.

ST CHARLES, MO The St. Charles ARC will sponsor HAMFEST92 at Blanchette Park in St. Charles MO from 6:30 AM-3 PM. Forums and License Exams (10 AM). Free admission and parking. Handicapped parking available. Fee for Flea Market space. Dealers welcome in air-conditioned hall. Talk-in on 146.67 and 444.65 rptrs, and 146.52 simplex. Contact ***Ron Ochu KØOZ, #5 Cricklewood, St. Peters MO 63376. Tel. (314) 278-2510***, or call ***Eric Koch NFØQ, (314) 946-0948 eves.***

MARYSVILLE, OH The Union County ARC will sponsor their 16th Annual Marysville Hamfest/Computer Show at the Fairground in Marysville OH (near Columbus). Overnight camping with electric and water hook-ups will be available on a first come basis. Free entertainment Sat. night. Undercover areas and buildings for set-up. 10' x 10' space $5. Commercial vendors, please act fast to reserve space. Admission $4 advance, $5 at the gate. Contact ***Gene Kirby W8BJN, 13613 US 36, Marysville OH 43040. Tel. (513) 644-0468.***

CRYSTAL LAKE, IL The Tri-County Radio Group (ARG) will hold a Radio/Computer Fest at Crystal Lake Holiday Inn. For info call ***Bob N9KXG or Ken N9KSP*** at ***(708) 658-1678 or (708) 658-3566.***

MULLICA HILL, NJ The Gloucester County ARC will hold its 15th annual Hamfest/Computer/Electronics Fair at the 4H Fairgrounds, Route 77. Advance tickets $3.50; $5 at the gate. Tailgating $5 per space. Vendors $7 per table. Electricity available. Set-up at 6 AM. General Admission at 8 AM. VEC Testing: Registration 9 AM-9:30. Testing begins at 10 AM. Talk-in on 147.78/.18 and 223.06/224.66. Enjoy our open-air Breakfast and Lunch. Contact ***GCARC, PO Box 370, Pitman NJ 08071***, or call ***(609) 478-4738.***

AUG 28-30

VERNON, B.C., CANADA The 1992 Sky High Hamfest, sponsored by the Okanagan Valley Hamfest Assn., will be held at the Silver Star Mountain and Resort area. The event will be organized by the North Okanagan RAC. RV accomodations, hotels, restaurants available. Non-Ham activities. For info, contact ***Sky High Hamfest, PO Box 1706, Vernon, B.C., Canada V1T-8C3.***

AUG 29

NEWPORT, NH Newport Area Hams will host the Sugar River Amateur Radio Summer Festival from 7 AM-4 PM. Tailgate Flea Market. VE Exams. Craft Fair. Book Sale. Special Event Demo Station. Outdoor Folk Concert at 6:30 PM. Flea Market admission: Sellers $5 (set up at 7 AM); Buyers $2 (admitted at 8 AM). Talk-in on 146.76/.16, 224.12/22.52 and 146.52. No tones, please. Contact ***Bruce C. Bedford KA1ORB, 178 Summer St., Newport NH 03773. Tel. (603) 863-1698*** or ***Bob Boyd N1CIR, (603) 863-5383.***

ROSEAU, MN The Lake of the Woods Rptr. Assn. Inc., will sponsor a Hamfest at the High School Gym, Highway #11 East. Set-up at 8 AM. Doors open at 10 AM. Buffet Banquet at 4:30 PM. VE Exams. ATV & Packet demos. Flea Market. Auction. Tables free with advance registration. Admission $10 all incl. Reservations are necessary. Contact ***David Landby KB0HAP, Rt. 3, Box 10, Warroad MN 56763. Tel. (218) 386-1092.*** Talk-in on 147.09+

AUG 30

MILFORD, CT VE Exams for all classes will be held at the Fowler Bldg., 145 Bridgeport Ave., Milford CT, beginning at 12 noon. Walk-ins welcome. For info call ***Gary NB1M, (203) 933-5125***, or ***Dick WA1YQE, (203) 874-1014***. This testing is sponsored by the Coastline Amateur ARA.

LEBANON, TN The Short Mountain Repeater Club will sponsor a Hamfest at the Cedar of Lebanon State Park, US Highway 231, seven miles south of I-40. Outdoor facilities only. Exhibitors bring your own tables. Space available on a first come basis. Free admission. Talk-in on 146.91. Contact ***Mary Alice Fanning KA4GSB, 4936 Danby Dr., Nashville TN 37211. Tel. (615) 832-3215.***

SPECIAL EVENT STATIONS

AUG

CHANNEL ISLANDS, CA KK6EK will operate during research expeditions for the month of August, to celebrate the 15th anniversary of the founding of Cordell Expeditions, a volunteer research group that was responsible for creating the Cordell Bank National Marine Sanctuary. Operation will be SSB, principally on 20m, usually 14.328. For special expedition QSL and info, contact ***KK6EK, Cordell Expeditions, 4295 Walnut Blvd., Walnut Creek CA 94596.***

AUG 4-5

PADUCAH, KY The Paducah ARA, in conjunction with the Paducah Police Dept., will operate W4NJA, to commemorate the 1st Annual Paducah Police Dept. D.A.R.E. Daycamp. Operation will be from 1400Z-2100Z. "D.A.R.E." stands for Drug Abuse Resistance Education, and the daycamp will be looking for contacts with all amateurs, expecially other D.A.R.E. participants. Operations will be in the lower 25 kHz of the 20m phone and the lower 50 kHz in the Novice 10m phone bands. For a special D.A.R.E. QSL, send an SASE to ***John Hudson KC4HGX, 3214 Lorine Ln., Paducah KY 42001.***

AUG 4-7

BLOOMINGTON, IL The Central IL RC will operate W9AML 1700Z-2400Z Aug. 4-7, in conjunction with the McLean Co. 4H Fair. Operation will be in the General portion of 80-15m and the Novice portion of 10m. For QST send QSL and SASE to ***CIRC, PO Box 993, Bloomington IL 61702.***

AUG 8-9

MOUNT DAVIS, PA The Somerset County ARC will operate Station KC3XD from the highest point in PA, at Mount Davis. Operations will be on the Lower 50 kHz of the General phone bands of 10-80m, as conditions allow. Send QSL and SASE to ***Sherman Gary KC3XD, 708 Casselman St., Confluence PA 15424.***

AUG 11-16

SANDUSKY, OH The Firelands ARA will operate Station WB8LLY Aug. 11 thru Aug. 16, during the Erie County Fair at the Heritage Barn to commemorate the 200th anniversary of the Connecticut Legislature setting aside the Firelands (in 1792), to compensate people that were burned out of their homes by the British during the Revolutionary War. Operation will be in the lower 50 kHz of the General phone subbands on 80m, 40m, 20m, 17m, 15m, 12m, and starting on the 10m Novice phone subbands (28.400) daily during the Fair. Radiograms for the Erie County area will be accepted via WB8LLY @ WB8JUI packet station. For certificate, send 9 x 12 SASE with two postage stamps affixed; QSL with contact number to ***Tim N8AHK, 1307 Fifth Street, Sandusky OH 44870-4201.***

AUG 14-16

SEATTLE, WA The Boeing Employee's ARC will operate a Special Event Station from the Museum of Flight, to commemorate the 50th Anniversary of the 1st Flight of B29. Frequencies: 28.400 MHz, 21.360 MHz and 14.280 MHz. Operating time will be 1700-2400 UTC. A QSL card with a black and white glossy photo of the B29 in flight will be sent to all who contact the Boeing ARC Special Event Station.

AUG 15-16

VANCOUVER,WA The Clark County ARC will operate Station W7AIA from the Evergreen Flying Field, just east of Vancouver WA, to help celebrate the 33rd annual Antique Aircraft Fly-in. Operation will be in the lower portions of the 40m, 20m and 15m bands (phone); they also expect some operation on the 75m phone band during the night. A very nice certificate will be available. Send your SASE (only) to ***CCARC, PO Box 1424, Vancouver WA 98668.***

AUG 22-23

LOS ANGELES, CA SE Station W1AW/6 will operate from the 1992 ARRL National Convention Aug. 22 and 23. Frequencies: General subband of 80m, 40m, 20m and 15m; Novice subband of 10m; and the VHF/UHF bands. For a certificate, send QSL and a 9 x 12 SASE to ***Hamcon, Attn: Dick Bruno N6ISY, PO Box 570756, Tarzana CA 91356.***

AUG 29

WRENTHAM, MA N1APE and N1IPR will operate from the Wrentham MA State School Cracker Barrel Fair and Hot Air Balloon Festival, Aug 29, 1400Z-2200Z. Frequencies: -7.243, 14.243, 21.343, 28.343. QSL and SASE for certificate to ***N1APE, 8 Abenaki Trail, Littleton MA 01460.***

AUG 29-30

WELLSBORO, PA The Tioga County ARC will operate Station WO3C from 1400Z Aug 29-1800Z Aug. 30, to celebrate the 99th anniversary of the Pennsylvania Park System. Operation will be in the lower portions of the General 80m, 40m, 20m, 10m. For QSL, send QSL and SASE to ***Darlene Rahn WO3C, Box 200 R.D. #6, Wellsboro PA 16901.***

SEP 4-5

BRADY, TX The Heart of Texas Ham Operators' Group (HOT HOG) of Brady, together with the 3M A.R.C. and the Brownwood ARC, both of Brownwood TX, will operate Station WD5H from the 19th Annual World championship Barbecue Goat Cookoff and 15th Annual Arts & Crafts Fair at Richards Park in Brady TX. This operation from the "geographic center of Texas" will take place primarily on SSB phone or about 28.325, 21.325, and 14.325 MHz, from 2000Z Sep. 4-2000Z Sep. 5. Rag chews are welcome. Some operators of this station may move off to other modes/frequencies at their discression. Ask if you are interested. For a certificate send your QSL and SASE to ***HOT DOG, c/o Larry W. Garens WD5H, 702 Bee St., Brady TX 76825-3014.***

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Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts, then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

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RANDOM OUTPUT

David Cassidy N1GPH

Contests

For almost a year now, I've been receiving a lot of letters and phone calls concerning contesting. Every hamfest I've been to this year has included at least one heated debate over the pros and cons of contesting. The general feeling is that contesting has gotten out of control.

Not being an avid contester, it would be easy for me to sit down at the word processor and write a fiery condemnation of contests and how they can be blamed for everything from QRM to the S&L crisis. In exchange for not doing that, I expect any avid contesters reading this to try to keep an open mind and look at things from another's viewpoint before taking crayon in hand and writing me hate mail. Let's see if we can have a reasoned and thoughtful examination of what's really happening.

Let's examine a few facts. It is a fact that there are a lot more contests these days than there used to be. The feeling of non-contesters is that there is a major, band-filling contest almost every weekend. While this is certainly an exaggeration, it does go to show the level of frustration felt by the non-contesting ham population.

It is a fact that a major contest makes any other type of communication on a certain band impossible. It seems that contesters feel that the rules about intentional interference and asking if a frequency is in use (which implies that you listen for a response and act accordingly) are not in effect during contests. Just listen to any frequency where a QSO is in progress at the starting time of any major contest. It doesn't take but a few minutes for a contest to take over a band, forcibly evicting any other amateurs.

It is a fact that contesting has become more and more automated as logging software, memory keyers, digital voice recorders and computer-controlled rigs have become more common. I've heard contesters who didn't key their mikes and actually speak a live word for over three minutes at a stretch.

There are two ways we can approach this issue. We can ignore it (which is what every avid contester I've talked to has advocated) or we can realize that we have a bit of a problem here, act like mature adults and come up with a compromise to benefit amateur radio. Other ways to approach the issue of contesting have been suggested, mainly petitioning the FCC to limit contest time and frequencies. Anyone who thinks the FCC wants to be bothered with this is woefully misguided and should sit in a cool, dark room until the feeling passes. (When are hams going to finally realize that the FCC doesn't like amateur radio; they hate dealing with amateur radio; and every time we force them to spend time on our petty problems and infighting we get one step closer to the end of the Amateur Radio Service?)

Ignoring this issue is certainly unfair to the majority of hams who are not contesters. After all, they're not asking for anything extraordinary. They just want to be able to practice their hobby, the same way contesters want to practice theirs. That leaves us with only one way to deal with this growing problem: compromise.

In the spirit of beginning a dialogue, I submit—in no particular order—the following ideas as a starting point.

1. Regulation of contests is the responsibility of the contest sponsor, *not the FCC*. If you have concerns about how contests are run, you should be writing to the sponsoring organization, *not the FCC*. If you are a sponsoring organization, you should be monitoring your contests for adherence to the rules and good amateur practice.

2. I don't think it is too much to ask that contest operating be confined to a portion of each band, leaving a portion for other amateur activities. We have band plans and "gentlemen's agreements" for all other types of special interest activities, so why not contesting? If contest sponsors will do this voluntarily, those who are shouting for FCC action no longer have an argument.

3. If special "contest zones" are set up, non-participating stations should have the courtesy to take their operations to non-contest frequencies for the duration.

4. Contesting was conceived as a way to sharpen operating skills while having a little fun (and maybe having a chance to work a rare state, zone, prefix, county, country, etc.). Automatic contacts do nothing to improve operating skills. I propose that any automation affecting the transmitted signal (i.e. memory keyers, digital voice recorders, computer-controlled rigs) should be banned. Contests should be a test of skill, not a measure of how much money you have.

5. A reasonable power limit should be placed on all contest stations (I would propose 100 watts). Remember, this is supposed to be a test of your *operating* skills, not a test of your MasterCard limit.

6. As hinted at in #1, it is the contest sponsor's responsibility to make sure their contest is not causing problems. To that end, I would suggest that each contest have a group of Official Contest Observers. These stations, whose callsigns could be advertised in advance, would be responsible for observing operations during the contest. They could advise stations when they were overdriving their processors, operating out of the contest band or interfering with another station. Any serious violations of FCC or contest rules could be reported to the contest sponsors, disqualifying the offending party. If contesters knew there was a good chance their scores would be disqualified, maybe you'd hear a lot less interference and 10-kHz-wide splatter.

7. Contest sponsors should take a hard look at their contest schedule to determine if any of their contests are duplicating the efforts of another sponsor. If they do, why not get together and eliminate some of the duplication. There is a fine line between offering a way for hams to have some fun and using a contest as a form of advertising.

I hope these ideas help to generate a dialogue between contesters and non-contesters. Write down your thoughts and send them in. We'll publish a representative sample of any letters we get.

It is in our own best interest to deal with this before the FCC does it for us. There is room on the amateur bands for everybody. All we have to do is cut each other a little slack and work out our differences constructively. 73

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

As this is written, the solar flux has just declined (for a day or two) to its lowest value in several years: 99. This means that the sun has indeed departed an extraordinary "plateau" of medium-to-high flux values that lasted for almost a year. As I mentioned before, it now appears that Cycle 22 did have a double peak, which extended the very good conditions on the HF bands longer than usual. However, unless this cycle will be longer, overall, than usual (and I don't think it will be) then we can expect a more rapid decline in solar flux values between now and the minimum in a few years. The "saddle" between the two peaks (1989-1992) provided some exceptional extended DX opportunities which we'll now have to forego and learn to live with diminished propagation conditions for the next several years. That is NOT to say there will be NO DX . . . just that it will be increasingly rare and will come and go more quickly.

August will NOT be a spectacular month for HF-band propagation. Conditions will range from Poor (centered around the 8th) to Good (centered around the 12th and 27th) to Fair for the remainder of the month. As always, you may expect these periods to vary one way or the other (later or earlier) by a day or two.

August is a transitional month between summer doldrums and fall brilliance. The "conditions" outlined above are trending toward seasonal improvement (September and October) and there will be some excellent, but rare, DX opportunities this month. Check the Good days and keep alert for sudden changes in WWV's eighteen-minutes-after-any-hour updates. The Boulder "A" index shows how ionospheric absorption values vary with daily averages (the higher the number, the higher the absorption) and the Boulder "K" index is a six-hourly average of magnetic field flux values. Both, of course, are related to magnetic field activity which can range from quiet to unsettled to active to minor storm and major storm levels. In general, the higher the solar flux and the lower the A and K indices are, the better conditions will be. The reverse is also true. 73

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GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	—	20	—	—	—	—	—
ARGENTINA	20	20	20	40D	40D		—	—	—	—	10	15
AUSTRALIA	—	—	—	20	20	40D	20D	20D	—	—	—	—
CANAL ZONE	15	20	20			—	20	20	20	—	10D	15
ENGLAND	20		[illegible]	[illegible]	—	—	—	—	—	20	20	20
HAWAII	15D	20	20	20	40D	40D	—	—	—	—	—	15D
INDIA	20D	20D	—	—	—	—	—	—	—	—	—	—
JAPAN	—	—	—	—	—	—	20	—	—	—	—	
MEXICO	15	20	20	—	—	—	20	20	20	—	10D	15
PHILIPPINES	—	—	—	—	—	—	20D	—	—	—	—	—
PUERTO RICO	15	20	20	—	—	—	20	20	20	—	10D	15
SOUTH AFRICA	—	40	40	20D	20D		—	—	—	—	20D	20D
U S S R	20	[illegible]	[illegible]	—	—	—	—	—	—	—	20	20
WEST COAST	40	80	—	—	—	—	—	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	20D		—	40D	—	20	—	—	—	—
ARGENTINA	[illegible]	[illegible]	20	40D	—	—	—	15	15	15	[illegible]	20
AUSTRALIA	15D	15D	[illegible]	20	20	40D	20	20	—	—	15D	15D
CANAL ZONE	20	20	20	40D	40D		20	20	[illegible]	15	10D	10D
ENGLAND	20	—	40D	40D	—	—	20D	20D	—	—	20	20
HAWAII	15	15	20	20	20	40D	20	20	—	—	—	15D
INDIA	20D	20D	—	—	—	—	20D	20D	—	—	—	
JAPAN	—	—	20D	—	—	40D	—	20	—	—	—	—
MEXICO	20	20	20	40D	40D	—	20	20	[illegible]	15	10D	10D
PHILIPPINES						—	20D	20D	—	—	—	—
PUERTO RICO	20	20	20	—	—	—	20	20	[illegible]	15	10D	10D
SOUTH AFRICA	—	—	40D	20D	20D	—	—	—	—	—	—	—
U S S R	—	—	—	—	—	—	20D	20D	—	—	—	—

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	20	20	20D	40D	20D	20D	—	—	—
ARGENTINA	15	20D	20	20	—	—	—	20D	—	—	—	15
AUSTRALIA	15	15	15	20	20	[illegible]	40	[illegible]	—	—	—	—
CANAL ZONE	10D	15	20	20	40D	40D	—	20	20	—	15	10D
ENGLAND	20	20	20D		—	—	—	20D	—	—	—	20D
HAWAII	15	15	[illegible]	20	20	[illegible]	[illegible]	—	20	—	15D	15
INDIA	—	—	20D	20D	—	—	—	20D	20D	—	—	—
JAPAN	—	—	—	20	20	20D	40D	20D	20D	—	—	—
MEXICO	10D	15	20	20	40D	40D	—	20	20	—	15	10D
PHILIPPINES	—	—	—	20D	20D		—	20D	20D	—	—	
PUERTO RICO	10D	15	20	20	40D	40D	—	20	20	—	15	10D
SOUTH AFRICA	—	—	—	20D	20D	—	—	—	—	—		
U S S R	20D	20D	20D				—	20D	—	—	—	—
EAST COAST	40	50	—			—	—	20	20	20	15	40

[illegible]

AUGUST 1992

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 F	3 F	4 F-G	5 G-F	6 F-P	7 P	8 P
9 P	10 P-F	11 F-G	12 G	13 G	14 G-F	15 F
16 F	17 F	18 F	19 F	20 F	21 F	22 F
23 F	24 F	25 F	26 F-G	27 G	28 G	29 G-F
30 G-F	31 F					

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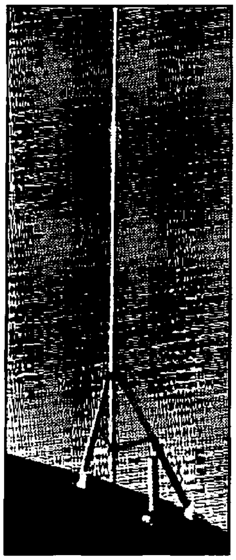
TABLE OF CONTENTS

FEATURES



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Cover: The Comet CX-224 Triband mobile antenna. See the review on page 26. Photo by David Cassidy N1GPH.

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Green For President

When Perot dummied out on the presidency, I got a pile (two) of letters asking why don't I run lor the job. Well, there are several good reasons. First. I don't have a hundred million. Second, it's a lousy job. Third, I'm 70 years old and thus very likely to drop dead any day now. Fourth, the media would have a ball Interviewing my enemies— and I've got a bunch.

I get to thinking about my enemies every now and then. I don't think you'll find one that I've screwed. The intensity of the hate that I generate seems to be proportional to the depth that I've been screwed. My biggest enemy took me lor about $100 million. That's enough to hate anyone for, I suppose. Of course I can look on the bright side—this has kept me from running for the presidency, with all that aggravation. The people who only took me for a few hundred thou are only moderate enemies.

Surely I'm exaggerating, right? I'm laughing, but it's a bitter laugh. I figure as long as I can make more money than people can steal, what the heck. And yes, I'm careless with both money and my things. I'm careless with people too, lending money to almost anyone who asks. One chap borrowed $25,000 to start a tape business . . . another $5,000 to start a computer art gallery . . . another $5,000 to set up a psychological therapy business . . . another $5,000 to help a newspaper grow . . . another $5,000 to keep a small magazine afloat. Then there was about $250,000 to set a chap up in a new software business. And $350,000 for a computer protection system. $250,000 in computer inventory got swiped from my stores and about $300,000 from my warehouse. One chap swiped about $10,000 in CDs to start a CD business. No, I don't think the media would have any problem finding endless testimony against me. How about the employee who sold himself 40 computers from our lab at scrap prices and resold them for around $100,000? He went to work for a competitor and died of a heart attack, so the *Enquirer* will have to get his story via a psychic. I'll bet even the ex-employee who broke into the ham shack recently and cleaned it out hates me now.

People aren't geared to take someone for a bundle without projecting the guilt. They don't want to feel guilty about what they've done to me, so they hate me and then it's okay.

Yes, it's a lot more difficult now to pry money out of me to start new businesses. You know, I've never yet had anyone pay me back. But then I've always just handed them the money without all sorts of contracts. I figured If I got it back I'd be able to help someone else. One chap did repay a little, but that ended after about two small payments. The others stopped calling or writing . . . or answering my letters.

I'm happy doing what I'm doing. I don't need or want the aggravation that comes with public office. And I don't know for sure how I'd react to the temptations. When you're a senator or representative it's easy to threaten one special interest after another and reap tons of money in lobbyist donations to keep you off their backs. Say, I wonder if you noticed that Senator Gore has consistently been one of the top recipients of PAC lobby donations? Talk about special interests having friends in high places, what with him aiming at the veep spot! That's not going to stop the money rolling in, I'll bet. Indeed, that could have been a strong factor in his being selected for the non-job.

I'm having fun helping performers get known via my record companies. Cabò Frio, a jazz group, is now on full rotation on the key radio stations in nine of the top markets and is about to go on a national tour as a result. Marty Balin has had a similar success with his "Better Generation" release on my Green With Envy label. He is also going on tour as a result. "Kukuruza," the Russian bluegrass group's release on my Greener Pastures Records, has been a hit in country circles, so they're coming back for another American tour this year—and will do another CD for us In my studios. And Scott Kirby has been in great demand for ragtime festivals, which is probably the closest there is to a tour In that field.

I'm also having considerable success in helping to get independent music to sell via my Adventures In Music series of CDs. We're up to about 75 of those now and turning out three to five new releases a month.

In the ham field *Radio Fun* has been doing fabulously. I've never seen anything like it In this field. The new subscriptions are coming in by the ton and renewals have set publishing records. The only fly in the ointment is the reluctance of some larger advertisers to change their old habits of doing all their advertising in *QST*. Well, that won't stop us, it just makes the publication a little smaller than I like and gives their competitors a substantial added advantage over them when it comes to selling to this huge newcomer market.

If you're into music you'll want to at least check out my new *Secret Guide to Music*—it's great fun. It's packed with reviews of music I, the editors and readers think you'll want to know about. I have some sneaky plans we're testing which, if they work out as expected, we'll also do with *Radio Fun*.

I'm not getting enough time for skiing or scuba diving. I've got to stop getting off on tangents like the book I've just finished on how to fix America's most serious problems. As I've mentioned, it came about as a result of my reports to the New Hampshire Economic Development Commission. I put 'em all together and am putting the book into New Hampshire bookstores to see how it's received. If it goes well we'll try for national distribution. You've read a lot of it In my *73* editorials over the last 20 years or so, so not much of it will surprise you unless your retention is poor.

Learning The Code

There still seems to be a good deal of confusion about this. Let me explain this as simply as I can. If you go about it the right way you can learn the code in a few days. If you go about it the wrong way it can take you months. Or worse, it can totally frustrate you.

The normal approach (the absolutely wrong approach, naturally) is to start by learning the letters and numbers. Then you start slowly and gradually building up your speed. Wrongo! Bummer! Totally wrong approach right from the start.

A far better way is to get a tape . . . or set up your computer to generate random letters, numbers and punctuation . . . and sit down to listen. You don't have to know the code for the letter B or Q. All you have to do is take pencil in hand, relax and listen for a dit to go by. Write down an E. Pretty soon you'll be able to listen to the tape and write E's down while you are talking with someone. It'll be automatic. Step two, listen for a dash. That's a T. As you listen for T's you'll continue writing down the E's as they go by. Once you get the T's automatically, you start listening for dit-dits and writing I's. And so it goes. You never hear a dah-dit-dit-dit and have to stop and think . . . oh yes, that's a B. By the time you're through the whole alphabet, numbers and punctuation, you'll know what dah-dit-dit-dit is because you've just written it.

About that time you can graduate to words, starting with dah diddle-dlt-dit dit (THE) and so on. I suggest you learn the letters in the order of their frequency of use in English . . . E-T-A-I-O-N-S-H-R-D-L-U. That half of the alphabet makes up about 90% of the letters you'll be using, so it pays to give them priority and the most use in your practice.

Ya got that? Learn sounds, not dots and dashes. And start with the sounds, not the letters.

What speed? It takes about the same length of time to learn the code at 13 per as it does 20 per, so if you're going to head for Extra, why not start out at 20 and not waste time on 13? The sound patterns just sound different. Completely different.

Now doesn't that make a lot more sense than starting with the dots and dashes, setting up a lookup table in one side of your brain, listening to the sound with the other, sending the code group over to the lookup table, finding the right combination, and then sending back the letter to be written down? Keep it all on one side of the brain so you won't be stopped dead by the shuttle speed of the brain . . . which bogs you down at about 10 wpm. It just can't go faster, so to hit 13 per you have to start all over anyway. Your brain isn't like a computer where you can plug in a faster microprocessor to speed things up.

If you don't have a good computer program lor generating random characters, there's always my Uncle Wayne's tapes. We've been selling a ton of 'em lately . . . and getting wonderful testimonials from happy no-coders who've moved on to higher grade licenses.

We're Homophobes!

The latest Lambda club newsletter accuses *73* of being anti-homosexual. Why? Because *73* didn't publish a news item about their club suing the ARRL because *QST* refused to print an ad for them. So, in addition to being a minority with precious little tolerance by society, now they're busy kicking their biggest ham radio supporter in the . . . er . . . unmentionables.

Well I have a news flash for them. I did editorialize about their incredibly stupid law suit. Apparently even ho-

Continued on page 92

LETTERS

Number 2 on your Feedback card

From the Hamshack

Patrick Thomas KG5TK, Corpus Christi TX Wayne, I love your editorials—they keep my faith. I work with kids and ham radio but shy away from clubs as they turn off my guests. Sad but true. Honestly, I have not met with them for a few years but the leaders are the same.

I am a recent (four years) ham and had a great elmer but felt the testing for code was harsh and very uninviting. The volunteers were not helpful nor encouraging in San Antonio or Corpus. I went out of town, to a smaller town, and was treated royally. It spurred me on to Advanced and I now send everyone to them for testing. I feel this is a critical area which is not discussed . . . the attitude of the testing unit is evident and, in most cases, is the only picture of our hobby that the large majority of hams see. I have no desire to associate with negative egos.

Rodney Jackson WA9NZF, Jacksonville IL I have been reading *73 Magazine* since it was 73 cents, so you know I am not a new reader. In addition, I was not a young engineering or mathematical wonder. At the ripe old age of 22 I made the decision to enter into the ranks of amateur radio. My elmer was a 16-year-old boy who thought I might show some promise as a student. I have held every license from Novice through Advanced. Yes, I learned the code, as did everyone. No, I did not "love it" as many profess to today. I never really enjoyed it. And, I rarely used it. After all, what was the most important thing as a ham, anyway? *Talking* to other hams!

Now, you have really begun to get under my skin lately with your editorials. Why? Well, you seem to feel that *all of us over the age of 50* ("Old-Timers"): revere the code, cry about tube days, love AM, never made (or make) anything, don't know anything about the newer communication activities and, worst of all, are incapable of communicating anything meaningful to another person on amateur radio. Well, Wayne, you are wrong. If you would stop listening to 14.313 and K1MAN and "kerchunking vacant repeaters" while your wife plays with Prodigy (QSOs on a commercial land-link computer system . . . really now, Wayne), you might find real communicators. She'd better make more contacts on the Prodigy system than you do with your "kilowatt and full-sized 3-element beam"! I have never owned a kilowatt, yet my walls and files are full of cards from meaningful communications. Yep, you probably won't find too many communicators during contests, nor will you find them on 2m either, unless you try a new no-code ham. They do like to communicate. They haven't learned the bad habits from the other bands yet.

How does one communicate on amateur radio these days? Well, Wayne, I would suggest you take that cute little Macintosh Notebook ("Made In Japan," by the way) away from your wife and unplug it from the telephone. Plug it into a TNC and your 2m handie and switch to the digital modes. Now, before you get up in the air about packet racket, at least someone is there who will be able to communicate with you, and it sure beats kerchunking repeaters for the weekend. Computers . . . for kids? Heck no. I started in computer-driven digital communications about four years ago with a VIC-20, and, I still have it. Do I use an IBM clone? Heck no. Why should I? I use a great little Commodore 64. I have meaningful communications every time I make or answer a CQ, no matter which digital mode, packet, AMTOR or Baudot. We keyboarders *enjoy* communicating. I have had great talks with fellows all over the world. Yes, there are DX stations on digital communications that also enjoy more than the quickie QSO exchange.

Have you tried to learn a new language lately? Why not? Must we American hams continue to be so egotistical to insist everyone use English? There are a number of books available which allow the ham to communicate well with amateurs in almost any foreign language. One of them, *Rose*, is one of your advertisers. Rose Publications now has four books in print covering languages from Spanish to Japanese, from Korean to Chinese and from French to Serbo-Croation. Now, how in the world do you communicate in those languages? Easy. Use digital modes. Type it into the computer. Response from foreign hams? Outstanding. Much more interesting than QTH, WX, RIG, RST, NAME . . . 73!!!

So, good editor, please try to remember that there are those of us who are over 50, do communicate, do use computers, do enjoy the technology of today, and yes, sometimes remember the old days when this was not all possible, and praise the advances of *our day.*

As soon as it was possible to send printed messages I was doin' 'em. I started in 1949 with the Model 12 TTY and my homemade terminal—still have it out in the barn—about a dozen 6SN7GTs—complete with auto-start/stop.

I started out with this on 147.96, when that was the only band where FSK or AFSK was permitted. I helped W2BFD set up the first 2m repeater in NYC on top of the Municipal Building in 1950. I pioneered RTTY on 11m. Worked all around the country on 80m with make/break while we were fighting the ARRL to get FSK allowed on the low bands. You're preaching to the choir.

OK, so there are a few old hams who aren't spending what's left of their lives making things miserable for as many people as possible. A few . . . Wayne

Marshall Welch Jr. W3JBJ, Williamsport PA I thought long and hard before writing this letter. I almost didn't bother but I think I have a valid point which I don't think you can easily argue.

I have been reading your editorials where you constantly bitch, cry, whine, bellyache, complain, etc. about how badly we need more new (preferably younger) hams. We need to double, even triple our numbers, you say.

While at the Dayton Hamvention I found myself in several situations where, had you been nearby, I would have liked to slap your ears off. One situation—standing in a *long* line to use the bathroom—I waited 10 minutes. My bladder ached and felt like it would burst. WE NEED MORE HAMS!, I tell myself (Wayne says so). Heck, with proper bladder control I should be able to wait 20 minutes.

Another situation—a 20-minute wait in line to get a sandwich. WE NEED MORE HAMS!, I tell myself. (I didn't stand in line . . . I guess I really didn't want that sandwich anyway.) So, instead of a burger, I'll go check out the ICOM and Kenwood booths. What a mistake! It was a nightmare. WE NEED MORE HAMS! I finally get somewhere near these two exhibitors and I'm trapped. I can't move forward, backward, left or right. I can't move anywhere, let alone look at any of the new equipment displayed. What if someone had a medical emergency? What if there was some sort of a panic and a stampede? WE NEED MORE HAMS! If the fire marshall had been asleep, he would have woken up in a hot sweat and known why.

I arrive home and figure I'll give the HF rig a workout. I tune across 20 meters; maybe I'll call CQ. The band is *so* crowded I give up even trying to find a clear spot. Oh well, maybe I'll pop open a beer. (Wayne says NO!) Maybe I'll see what's on the boob tube. (Wayne says NO!) WE NEED MORE HAMS!

My point, Wayne, is that sometimes you are extremely biased and often wrong. A good example is this bull about how we gotta get a *lot* more hams. Why don't you loosen up a bit? Sometimes I think some of your ideas are as old as you are. Besides, most youngsters could care less about ham radio. If they want in, GREAT! By all means, elmer, encourage, and welcome them. But maybe they want to play with computers. Or, with girls!

Wayne, ham radio is doing just fine and growing at an acceptable rate, and it will continue to prosper long after you are gone. Take your panic button and disconnect it, OK?

I thought I was wrong once but I made a mistake . . . Wayne

Pete Bartholomey KD4GKQ, Jacksonville FL I just wanted to pass on a note concerning the direct frequency conversion for the Ramsey FX-146 article by Cecil Moore KG7BK in your June 1992 issue.

I bought his EPROM kit for my Ramsey FX-146 and when it arrived it was an improved version with excellent features but lacked the frequency coverage as outlined in the article. Since I was interested also in receiving the NOAA weather broadcasts on 162.550 MHz, I sent him a letter with that request.

Well, I must say he bent over backwards to find a solution. He sent me several sets of EPROMs with different solutions, the last one being the best and simplest to set up. Now I can tune all the NOAA frequencies instead of just one, plus all of the 2 meter frequencies and their offsets. It's apparent to me that he has a sensitivity to a reader's problem and was eager to help. My goal was met and I am very pleased with the article and his service.

As a brand-new Tech my very first amateur project was the Ramsey FX-146 transceiver as described by Rick Littlefield K1BQT in the December 1991 issue. I had a few problems but all were resolved.

73 Magazine is an inspiration, involving me in the inner workings of my gear and promoting the hobby as a whole. I look forward to similar articles in the future.

Ken Getzin, Rancho Palos Verdes CA A few weeks ago, during my once-in-every-decade peak of interest in amateur radio, I wandered into the local bookstore to buy a copy of *QST*. Alas, they had none and the only publication which had any promise of fulfilling my urge for information was your publication, the June issue of *73*. With some reluctance (after all, it was second choice), I made my purchase and retired to my home front to catch up on the past 10 years.

I was surprised! I found a well-written and edited publication, with information of interest to me. But what I really found to be of primary interest was your column, Wayne, "Never Say Die." As I implied earlier, I have a peak of interest in ham radio about every 10 years. This has been going on since I was in grammar school and, as I am approaching retirement, it has been a long time. Something always seemed to get in the way of getting my ticket. This time the breaks seem to be going my way. I had heard about the "no-code" license but had not taken this possibility seriously as I expected that such a license would just relegate me to operation on unpopular bands with low power. But after reading your magazine I found, to my delight, that I could indeed operate over a wide spectrum of useful bands and that equipment has improved to the point where, for a reasonable investment, I could almost immediately participate in the ham fraternity.

A second break I received was in the form of a notice I saw from the amateur radio club at work, W6VPZ/6, which was offering lunch-time classes for prospective codeless Technician licensees. I immediately signed up and by the time you read this letter I should have passed my test and will be awaiting my ticket. You mentioned the unfriendliness of some clubs to the codeless Technicians. I want to hold this club up as an example of the spirit of ham radio, as per part 97, as they want to help bring new hams into the fold, work hard to do it, and will continue to do so. Even though I won't have my license by then I expect to participate in the next Field Day at the end of the month (June), even if I am just a grunt helping to move the big delta they will be using for their QRP work.

This sort of brings me to the next break. Now that my appetite is whetted, I need to move on to the next step: "THE CODE." Here your editorial was also inspiring. For the first time I felt that there was a chance not only to get to 5 wpm but to 20 and beyond. I see an Extra ticket by a year from now. The ideas you recommended in your editorial relative to learning the code are quite interesting and if it works as you say it is a major breakthrough not only in the teaching of code but maybe even foreign languages. I would hope that you will expand upon your proposed teaching method in a future publication. In the meantime, I will take the challenge, and under separate cover I will be ordering your set of tapes and diving into the code.

Angus McLeod 8P6SM, Bridgetown, Barbados I think *73 Amateur Radio Today* is the best of the pack and I enjoy your "Never Say Die" editorial tremendously, but you really should take a leaf from your own book. I have just been rereading your editorial in the June 1992 issue and you finish with the suggestion that articles about digital audio and digital signal processing would be welcome. Why don't you stop skipping "that digital crapola" and give us the articles?

If by digital audio you mean hi-fi, it might be a little out of place in a publication intended for amateur radio but I for one would be generally interested. More so if a radio-related application could be devised. And I for one would be absolutely thrilled by an in-depth series followed by a regular column on DSP techniques. I own a DSP-12 and would love some tips on how to make it sit up and beg.

So, let's hear less about how the OTs would react. By definition, they will all be dead soon anyway. Give us the goods, Wayne, and let's see what happens next.

73 Awards Program Scam

A situation has been brought to our attention regarding *73*'s former awards program.

Many years ago, *73 Magazine* ran an extensive awards program, with different awards for working different areas of the world. This program has not been active for many years, yet many people continue to send the administrative fees and applications to the former awards manager (who does not work at the *73* offices in New Hampshire). It appears that this person, who we have been unable to contact, has been receiving applications and keeping the money.

THE ONLY AWARD CURRENTLY AUTHORIZED AND SPONSORED BY *73 AMATEUR RADIO TODAY* IS THE DX DYNASTY AWARD, AND THE MAILING ADDRESS FOR THAT AWARD IS THE SAME AS OUR EDITORIAL OFFICE (PETERBOROUGH, NEW HAMPSHIRE).

If you know of anyone who is active in certificate hunting, please pass along this information.

Text Released on Proposed "No-Business" Rule

The FCC released their *Notice of Proposed Rule Making* to lessen restrictions on permissible communications that amateur stations may transmit. In a nutshell, the Commission proposed to permit greater flexibility for public service and personal communications.

This proposal strikes at the very heart of ham radio since it details new directions in amateur communications. It is the most important proceeding since the codeless Technician matter.

Section 97.113 would be revised as follows:

97.113 Prohibited Transmissions

(a) No amateur station shall transmit:

(1) Communications for hire or for material compensation, direct or indirect, paid or promised except as otherwise provided in these rules;

(2) Communications in which the station licensee or control operator has a pecuniary interest including communications on behalf of an employer. Amateur operators may, however, notify other amateurs of the availability for sale or trade of apparatus normally used in an amateur station provided that such activity is not conducted on a regular basis;

(3) Music; Communication to facilitate a criminal act; Message in codes or ciphers intended to obscure the meaning thereof, except as otherwise provided herein; Obscene, indecent, or profane words or language; or false or deceptive messages, signals or identification;

(4) Communication on a regular basis which could reasonably be furnished alternatively through other radio services.

(b) An amateur shall not engage in any form of broadcasting. Nor may an amateur station transmit one way communications except as specifically provided in these rules; nor shall an amateur station engage in any activity related to program production or newsgathering for broadcasting purposes except that communications directly related to the immediate safety of human life or the protection of property may be provided by amateur stations to broadcasters for dissemination to the public where no other means of communication is reasonably available before or at the time of the event.

(c) A control operator may accept compensation as an incident of a teaching position during periods of time when an amateur station is used by that teacher as a part of classroom instruction at an educational institution.

(d) The control operator of a club station may accept compensation for the periods of time when the station is transmitting telegraphy practice or information bulletins provided that

(1) The station transmits the telegraphy practice and information bulletins for at least 40 hours per week;

(2) The station schedules operations on at least six amateur service MF and HF bands using reasonable measures to maximize coverage;

(3) Where the schedule of normal operating times and frequencies is published at least 30 days in advance of the actual transmissions; and

(4) Where the control operator does not accept any direct or indirect compensation for any other service as a control operator.

(e) No station shall retransmit programs or signals emanating from any type of radio station other than an amateur station, except propagation and weather forecast information originating from United States government stations, and communications originating from United States government stations, and communications originating on United States government frequencies between a space shuttle and its associated Earth stations. Prior approval for such retransmission must be obtained from the National Aeronautics and Space Administration. Such retransmissions must be obtained from the National Aeronautics and Space Administration. Such retransmissions must be for the exclusive use of amateur operators. Propagation, weather forecasts and shuttle retransmissions may not be conducted on a regular basis but only occasionally as an incident of normal amateur radio communications.

(f) No amateur station, except in auxiliary, repeater or space operation may automatically retransmit the radio signals of other amateur stations. *TNX W5YI Report, Vol. 14, Issue #14, July 15, 1992.*

New Radio Technology in Japan

The JARL (Japan Amateur Radio League) reports that Tohoku Electric Power Corp. has developed new radio technology that permits single frequency, two-way simultaneous radio communications. The end result is telephone-like audio because both sides of a voice conversion can be heard at the same time on a single frequency.

Most business radio stations use only one frequency; therefore a dispatcher and the receiver can not talk simultaneously. Each party must press the "push-to-talk" button whenever he or she wishes to speak and release the button to hear the other party.

The newly-developed radio system divides the operator's voice signals into 0.2-second sound segments and compresses them into half the time before transmission. The other half of the time is allocated to receiving similar messages from the other party. This allows both voices to be effectively transmitted at the same time on a single frequency.

JARL says the new technology can be utilized in other radio services—including amateur radio. *TNX W5YI Report, Vol. 14, Issue #14, July 15, 1992.*

"Let's Talk Radio Network" Sold; Now Operating from Los Angeles

Jim Bass has sold his satellite-delivered "Let's Talk Radio Network" to a consortium of media-related hams headed up by Blair Alper KA9SEQ and Frank Collins N6TAF. The LTRN service, which features programs geared toward ham, SWL and satellite dish owners, is delivered over the GTE Spacenet III (S3) communications satellite via Transponder 21, on the 6.2 MHz wideband audio subcarrier.

The new LTRN will be operated by a Board of Directors that includes Alper, Collins, Vern Jackson WAØRCR of the Gateway Net, Walt Garrett NØMAL of *Ham Stuff* and the Ham Radio Business Council, Hap Holly KC9RP of the Radio Amateur Information Network, and Bill Pasternak WA6ITF of Newsline. Other influential hams are being recruited as well.

The Let's Talk Radio Network is currently operating on the following schedule: Friday starting at 5 p.m. Eastern time continuously through 2 a.m. Sunday; Monday through Thursday, every evening from 5 p.m. through 1:30 a.m. Eastern time.

Among the wide array of communications-related programs there are several shows of specific interest to amateur radio operators. Every Tuesday night at 7 p.m. you can tune into the RAIN (Radio Amateur Information Network) Spotlight by Hap Holly KC9RP and at 8 p.m. you can listen to a show called the Elmer Classroom of the the Air that teaches amateur radio via the satellite. The Amateur Radio Weekly show airs every Saturday afternoon at 5 p.m. Eastern time. Hosted by Frank Collins N6TAF, this two-hour live segment offers amateur radio news items along with live interviews.

If you're interested in obtaining satellite air time, contact Frank Collins N6TAF or Blair Alper KA9SEQ at (800) 952-9810. *TNX Steve Coletti, Westlink Report No. 628, June 30, 1992 and Frank Collins N6TAF for the info.*

Three New Astronaut-Hams

Three more NASA astronauts have passed their Technician class examinations. All three took the test at the HamCom Convention in Houston the weekend of June 6th and are scheduled to join Pilot Ken Cameron KB5AWP on a shuttle mission in March of next year.

The three new ham-astronauts are Ellen Ochoa, Mike Foale and Ken Cockrell. Foale is reported to have bought a 2 meter rig at the convention and is gnashing his teeth waiting for his ticket to arrive. Ken Cameron KB5AWP last flew on STS-37 in April 1991. *TNX ARRL, Westlink Report No. 628, June 30, 1992.*

TNX . . .

. . . to all our contributors!

The RASER

A novel wire antenna system.

by James E. Taylor W2OZH

The length of a high-gain antenna for the 75 meter band is often limited by the available space. For example, my lot measures somewhat over 200 feet in the north-south direction and I would like to improve signal strength (gain) in the east-west direction. Conventional wisdom would dictate that I'm stuck with a half-wave dipole (length ~120 feet) because there isn't sufficient space available for a collinear two half-waves in phase (~240 feet). I would like to add length in the center of the dipole (where the radiation is greatest) in increments much less than 120 feet and still have the currents remain in-phase so as to increase the gain in the east-west direction.

Design details will be shown for two such enhanced dipoles. Both are fed with coaxial cable without the need for a separate tuner. One is end-fed and its development is described in some detail. The other is center-fed and it is covered at the end of this article. In each of the antennas the power gain relative to a dipole is a factor of two, with a length of less than 210 feet.

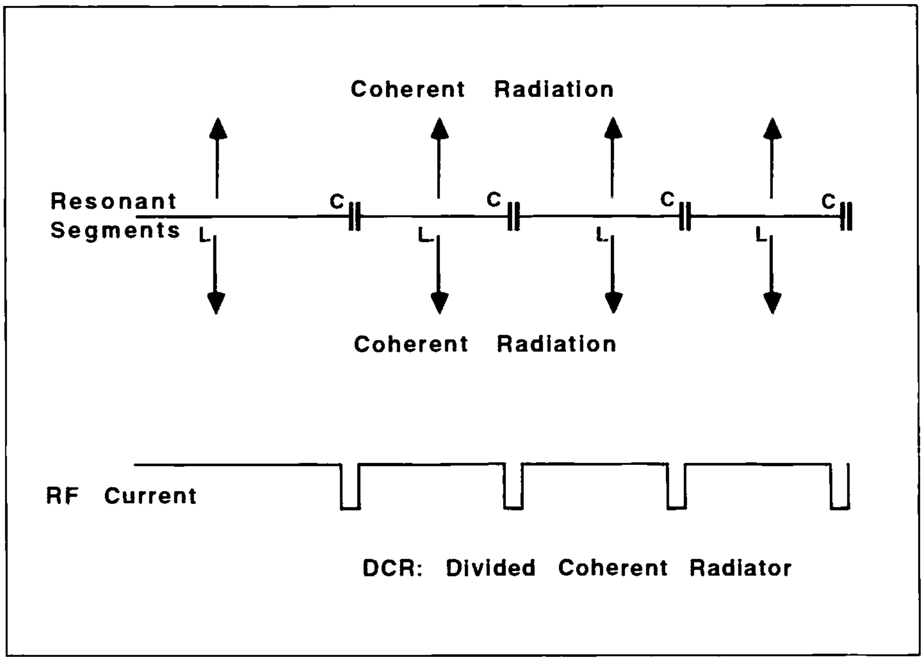

Figure 1. Divided coherent radiator

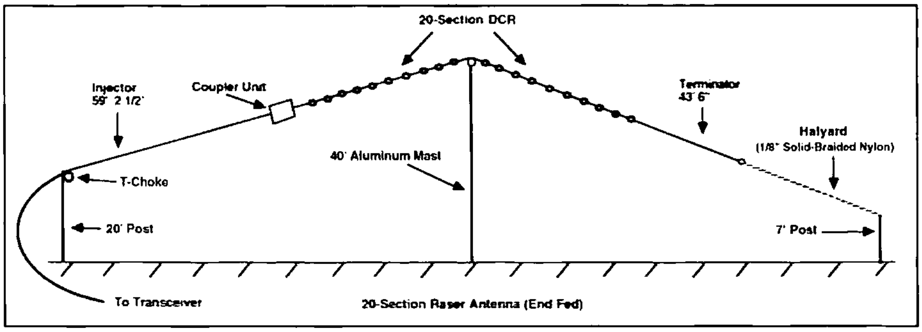

Figure 2. 20-section RASER antenna (end-fed).

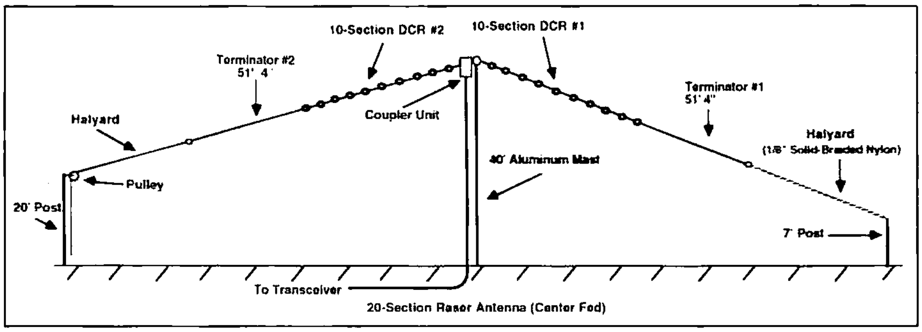

Figure 3. 20-section RASER antenna (center-fed).

The Franklin/CCD Antenna Concept

Those who are familiar with the history of radio may know of the Franklin antenna, named after its inventor. This concept involves the modification of current distribution in the elements of an antenna by the introduction of series capacitors. General descriptions of early applications of the concept may be found in H. Jasick's *Antenna Engineering Handbook*, First Edition, pp. 4-35 and 4-36, McGraw-Hill publisher: or F. Terman's *Radio Engineers' Handbook*, First Edition, pp. 773 and 774, McGraw-Hill. Harry Mills W4FD and others have adapted the concept to the ham bands in the form of resonant dipoles or loops fed with high impedance line. Mills developed a resonant radiating system which, for 80 meters, was made up of 48 self-resonant sections, each 70 inches long—a total length of 280 feet. See H. Mills & G. Brizendine, "Antenna Design: Something New!," *73 Magazine*, Oct. 1978, pp. 282-289. Kaplan & Bauer developed calculations for "stretched" resonant radiators made up of multiple tuned sections where the series tuning capacitance is half that needed to resonate the wire in each section, the other half being used to resonate the

system. In this case, care must be exercised to avoid compromising the phase and, therefore, the coherence of the radiation from the separate sections (see S. Kaplan & E. Bauer, "The Controlled Current Distribution Antenna," *ARRL Antenna Compendium*, Vol. 2, pp. 132-135).

This project uses a different approach. Here we insert series self-resonant sections into a resonant dipole antenna. This results in a coherent (in-phase) radiator for 75 meters, having extended length with a corresponding increase of gain and aperture. A simple empirical method is given to accomplish this without complicated computations. In the past such an arrangement has been referred to by the acronym CCD: Controlled Current Distribution. However, that acronym is now almost universally accepted to mean Charge-Coupled Device. Thus, I prefer to use the less confusing term "DCR": Divided Coherent Radiator.

The Divided Coherent Radiator Concept

If we consider a short length of wire carrying RF current, it has an inductance which can be readily calculated. If the current is to be essentially constant along the wire, its length must be a small fraction of a wavelength—for example, a fiftieth of a wavelength. For a chosen frequency the value of series capacitance required for resonance can then be calculated. At this frequency the tuned circuit is, of course, non-reactive; that is, essentially, it acts like an element of pure radiation resistance. If we place several of these tuned sections in series, as in Figure 1, their currents will be in-phase and the resulting radiation will be coherent, i.e. mutually reinforcing. Note that we are placing the DCR elements of pure radiation resistance in the center of a dipole which is then trimmed for resonance, rather than demanding that the entire multi-tuned structure be self-resonant.

The RASER Configurations—End-Fed and Center-Fed

This antenna is called a RASER because of its broad functional commonality with the LASER—both utilize multiple coherent radiating elements to achieve gain. Two RASER configurations were developed in response to needs generated by different site restrictions. The first, for end-feed, is derived from the RFD design ("RFD-1 and RFD-2: Resonant Feed-Line Dipoles," by J. Taylor, *QST*, August 1991, pp. 24-27). A second configuration, for center-feed, is reviewed briefly. Both use coaxial feedline. Neither design requires an antenna tuner and each provides an excellent impedance match with adequate bandwidth for normal amateur use. Figure 2 shows the final dimensions of the end-fed RASER and Figure 3 shows the center-fed arrangement. Of course, the heights above ground may vary for other locations.

Increasing the Aperture

Figure 4 is a diagram of the basic RFD-1 antenna system (shown in *QST*, August 1991, pp. 24-27, ref. above). Here I have labeled the input branch of the dipole radiator the "Injector" and the output branch the "Terminator." To develop this antenna, I first resonated the RFD-1 in the normal fashion, then introduced as many DCR sections as desired between the injector and the terminator. Since the RFD-1 is a resonant dipole antenna it continues to function as such even after the essentially non-reactive DCR sections are inserted, but with increased aperture and gain. *[Ed. Note: Due to the sinusoidal distribution of current in the dipole, the principal radiation will be from near its center. For example, the distance between the 6 dB power points (current 1/2 the maximum value) will be λ/3 for 75 meters, about 80 feet. This is a measure of the aperture over which the radiated wavefront is approximately plane. Thus, if we can add a DCR effectively equal to this length we will have doubled the aperture of the antenna.]* Residual mutual inductive and capacitive effects within the radiating system are compensated for by shortening both the DCR sections and the terminator. Simple coupler units (see Figures 5 & 10) assures accurate impedance matching at the desired resonant frequency.

Determination of DCR Design Parameters

The optimum lengths of the tuned sections of the DCR were determined by first calculating the inductance of a λ/50 length, then calculating the capacitance required for resonance (see F. Terman's, *Radio Engineer's Handbook*, First Edition, p. 48ff.). These simple calculations do not take into account mutual inductance and capacitance among the adjacent sections of the DCR. These effects were conveniently compensated for experimentally. The resulting parameters are shown in Table 1. Values for other frequencies can be scaled from these values.

These values are of key importance in the scaling of future RASER antennas for other frequencies. During the development of the design, I used, successively, DCRs having segments of several different numbers of sections which were mechanically separable by coaxial connectors. This was to derive and confirm the parameters of coupling and the optimum lengths of the sections and of the terminator as described above. However, now that the parameters have been determined, these tests need not be repeated in the future. I decided on a 20-section RASER because my lot is only about 220 feet from front to back. However, you can use more or fewer sections, depending on site dimensions—only the terminator dimensions and the coupler constants need be appropriately readjusted (see Table 1) to compensate. Alternatively, the RASER can be bent around the site, but with a less predictable pattern. Nevertheless, the increased aperture will still be beneficial, as will the other advantages cited by Kaplan and Bauer, including: improved directivity, reduced end effects and attendant losses, improved flexibility of

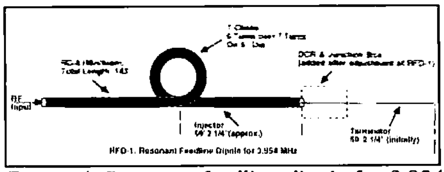

Figure 4. Resonant feedline dipole for 3.954 MHz

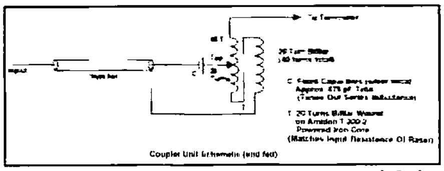

Figure 5. Coupler unit schematic (end-fed).

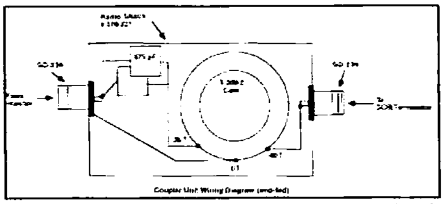

Figure 6. Coupler unit wiring diagram (end-fed).

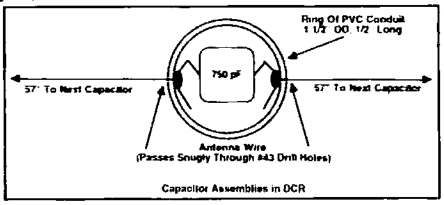

Figure 7. Capacitor assemblies in the DCR.

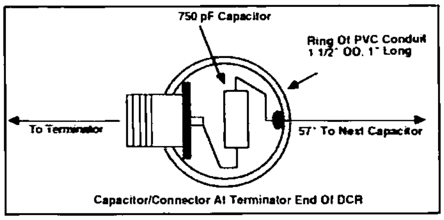

Figure 8. Capacitor/connector at the terminator end of the DCR.

scaling its length, broadband characteristics, and better operation close to the earth.

Coupling to the RASER

The addition of the DCR to the RFD-1 antenna increases the input impedance from the 50 ohm resistive value. This is because of the added radiation resistance and also because of any residual mutual reactance introduced. Several approaches were considered but the simplest and most satisfactory involved the use of a powdered iron toroidal autotransformer with a selected, fixed, series capacitor at its input, as shown in Figure 5. The bifilar transformer serves, primarily, to match the impedance to that of the line; the capacitor tunes out residual series inductance. This simple, compact coupler circuit, housed in a convenient plastic housing, (see the Parts List) enables a precise 1:1 SWR.

Referring to the Parts List, the recommended feedline is RG-8/M (Minifoam) having a total length of 143': (~59' Injector + ~22' T-Choke + ~62' λ/4 Lead-in). The minifoam is chosen for its light weight and the 62' (~λ/4) lead-in provides a measure of

added isolation. For convenience, I have used coaxial connectors at strategic spots. Two SO-239s are mounted in the two ends of the coupler box which contains the autotransformer and the fixed capacitor(s), C, as shown in Figures 5 and 6. Final adjustments are described below. The T-choke is wound on a plastic spool. The spools which I used were the red plastic items which wire suppliers have. The winding channel is 6" diameter x 2-1/4" wide. The T-choke comprises seven turns close-wound with six turns wound back in a second layer so that turn #13 is adjacent to turn #1. This coil is adjusted using a noise bridge or an SWR bridge. A supporting rope is tied around the spool and the T-choke is raised for final adjustment of the RFD-1.

Fabrication of the DCR Sections

The DCR sections were designed for strength, lightness of weight and low wind resistance. Cut 20 lengths of the antenna wire to 57" each. The 750 pF capacitors are each contained in 1/2" long rings cut from the PVC tubular conduit. The rings can be neatly cut using a rotary copper tubing cutter. I did it best by supporting the conduit internally using a plastic fitting (available at the plumbing distributor) slipped inside. The cutter was clamped in a bench vice and the tubing was rotated to produce a clean cut. (The DCRs should be tested in the system before the potting compound is applied.) The capacitor assemblies are shown in Figures 7 and 8. The leads of the capacitor and the stranded wire are bent for stress relief. An excess of solder is used here to reinforce these joints as there can be considerable torsion during high winds. The terminator was initially measured to be 59' 2-1/4" long after allowance for the end insulator which is, conveniently, one of the 1/2" long rings of conduit. This terminator length was used for initial adjustments of the T-choke in the RFD-1. After these adjustments, the terminator length was reduced to the final value of 43-1/2' (for the 20-section RASER).

Construction of the Supporting Mast

As with any low frequency antenna system, all parts of the RASER should be mounted as high as possible above ground. At W2OZH I have, for a number of years, used a 2-element phased array (see J. Taylor, "An 80m Phased Array," *73 Magazine*, March 1975, pp. 52-54, 56) with the manifest advantages of switchable directivity. I now use two 20-section RASERs in such an array. The arrangement shown in Figure 9 has proved to be quite practical for the two masts supporting the RASER elements. The 4" diameter aluminum pipe is light, easily erected, and it is sufficiently rigid to permit minimal guying. The pivoted cord-reel at the top acts like a huge pulley so that rope, knots, clamps, insulators, etc. can be easily pulled over the top with no trouble—a great advantage both for installation and experimentation.

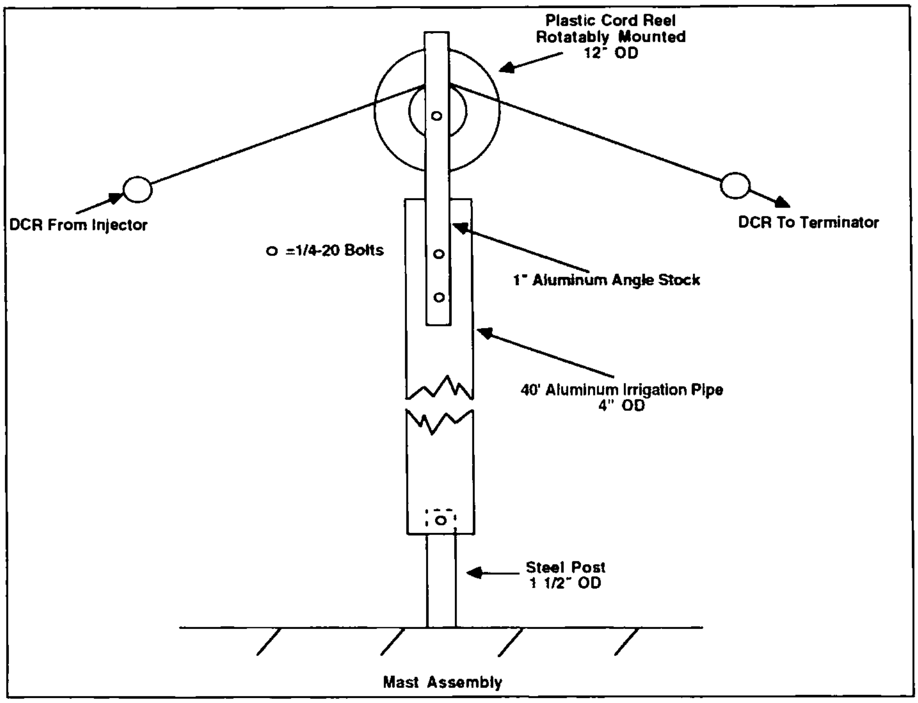

Figure 9. Mast assembly.

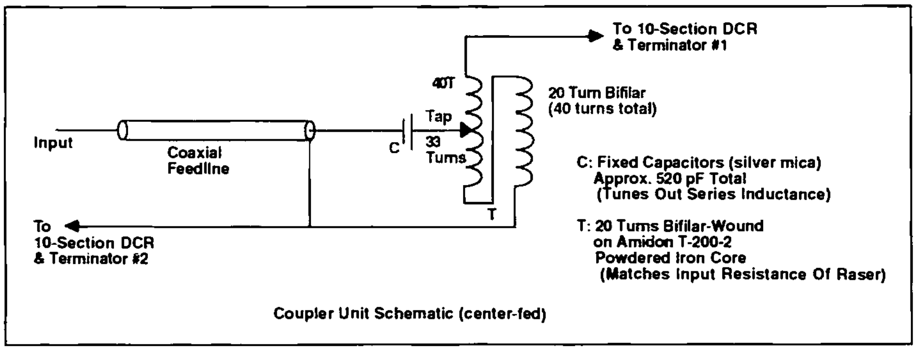

Figure 10. Coupler unit schematic (center-fed).

Resonating the RFD-1

The RFD-1 was assembled as in Figure 4 and adjusted for 50 ohms input resistance as mentioned above (without the DCR and coupler). After the T-choke has been adjusted, the coil is taped in place so that the windings won't shift. We are now ready to adjust the complete RASER.

Adjusting the Coupler

The capacitance and the position of the tap in the coupler are determined after the length of the terminator has been reduced, from Table 1, as appropriate for the number of sections chosen for the DCR. First, the tap and the silver-mica capacitors can be clipped in place and the antenna raised to its normal height before measuring the input impedance, for example, using a noise bridge. From my experience, it should not be necessary to compromise on these values—a precise 1:1 SWR should be attainable. For the two 20-section end-fed RASERS constructed the taps turned out to be at 24 turns and 28 turns and the capacitance 465 pF and 487 pF respectively. Thus, the mean values of 26 turns and about 476 pF should be a good starting point for a specific installation of a 20-section RASER. For another number of sections in the DCR the terminator will be changed appropriately from the initial value from Table I. The proper tap and capacitor are then determined experimentally. I found a variable capacitor or decade box to be quite valuable for such preliminary measurements, which were first made with the coupler box at stepladder height.

Results

One question which occurs for any antenna is: What is the SWR as a function of frequency? I measured the SWR for two 20-element RASER systems using a Heath SWR bridge at the input to the two-wavelength-long feedline used. For each, the measured value was 1:1 from 3.900 to 4.000 MHz. The value was less than 1.1:1 from 3.850 to 4.050 and under 1.5:1 from 3.750 to 4.200 MHz. Thus, the system has a relatively broad passband. One other experiment was done to confirm the proper operation of the DCR. A 10-section RASER was erected at stepladder height and the RF current in the DCR sections and in the adjacent injector and the terminator were checked, using an

Table 1. Raser Parameters—Calculated and Empirical

Assumed frequency: 3.954 MHz
Initial lengths ol RFD-1 injector and terminator: 59' 2 1/4"
Wavelength: 249'
1/50 wavelength: ~5'
Capacitance for resonance: ~750 pF
Calculated self-inductance: 2.15 µH
Empirically determined optimum values:
DCR Length: 57" per section
Reduction ol terminator per DCR section added: 9.425"
Calculated terminator length lor 20-section RASER: 43-1/2'

RASER Parts List (For convenience, optional suppliers are indicated)

#200'	Antenna wire	7 x #22, stranded, copper-clad (W1JC)	
143'	Coaxial cable	RG-8 (minifoam) (Radio Shack)	
1	Plastic box	4" x 2-7/16" x 1-1/16" (Radio Shack)	
Assorted	Silver-mica capacitors	50 pF to 500 pF	(Fertik's Electronics, 5400 Ella St., Philadelphia PA 19120)
20	Silver mica capacitors	750 pF	(Fertik's)
#5'	Thin-walled PVC conduit	1-1/2" o.d.	(MPT db4PVC1120 at plumbing distributor)
Foam epoxy potting compound lor electronic assemblies			(Spray-can insulating foam for plumbing sealing should work.)
#1	Type T-200-2 powdered iron core		(Amidon Associates, 12033 Otsego St., N. Hollywood CA 91607)
10'	Parallel bell wire	2 x #20 in plastic sheath	(Servistar Hardware Store)
4	Type SO-239 coaxial sockets	(Radio Shack)	

MFJ H-Field probe. The meter measured essentially the same reading throughout, indicating the desired constant-current operation of the DCR sections.

The RASER system produces a readily discernible gain over a non-enhanced dipole. Two RASERs used in a switchable phased-array (see J. Taylor, "An 80m Phased Array," referenced above) gave front-to-back ratios as high as 35 decibels. The directivity of each RASER is quite pronounced. Reported signal strengths are outstanding with output power of 100 watts or less. Stations in the preferred E-W direction are worked with uniform superiority, whereas those in the N-S direction arc seldom worked—there is no free lunch! The RASER phased array has been in operation at W2OZH for a year now and it has shown clear improvement over the dipole-based array previously used.

Addendum: The Center-Fed RASER (A Double-Edged RASER)

The RASER described, shown in Figure 2, is most suitable for sites which favor an end-fed antenna. For sites which favor center-feed, the version shown in Figure 3 was constructed using the principles already developed. Briefly, it was only nccessary to split thc 20-section DCR into two equal parts and connect a coaxial feedline into a coupler unit at this point. The injector of the RASER was replaced by a second terminator. Each of the two terminators is 51' 4". The diagrams, Figures 3 and 10, indicate the changes in geometry and coupler constants. The center-fed RASER is currently in daily use in the phased-array at W2OZH, with results which are essentially the same as those experienced for the end-fed RASER.

Conclusion

This development project was initiated to satisfy the need for an end-fed dipole antenna system having enhanced gain while retaining the efficiency and simplicity of feed which is characteristic of the RFD approach. The RASER system described above provides the desired enhancement. It offers an excellent match to the transceiver, without a separate antenna tuner, and without a dangling feedline to contend with. The concept is applicable to other bands and, because of its broadband characteristics, all-band operation, using an external tuner, should be possible. For locations where center feed is desired, suitable changes in design values were developed and tested.

Acknowledgments

I wish to acknowledge encouraging telephone conversations with Harry Mills W4FD, and with Gene Brizendine W4ATE, whose joint paper originally triggered my interest. Thanks are also due the numerous 75 meter hams who showed interest and who gave me comparative signal strength reports.

Number 5 on your Feedback card

My Longwire Antenna

Cheap, no-fuss and it's got gain!

by Dean Frazier NH6XK

There are instances when a ham wants propagation in several general directions, with gain, on more than two or three bands, to take advantage of different propagation conditions at different times of day. Living in Hawaii, almost all of my HF work is off-island DX, across water, for very long hauls. It is very enjoyable to be able to operate all bands through the day and into the night as each band "comes in" and subsequently "goes dead"—early morning 20 meters to Africa/Europe; 10 meters in the day to the U.S. mainland, VK-land, and Asia; 12, 15, and 17 to Oceania; 20 again to South America, as well as 15 meters, in the afternoon; 30 meter CW in the evening to almost anywhere; 40 meters in the evening to VK, ZL, and the U.S. mainland; and 80 meters also to the big "Big Island."

My longwire puts signals on all of these bands, just about centered in each of the directions I wish to propagate. It's a cheap, no-fuss antenna (it's a piece of wire!), and it's got gain.

The Longwire

My end-fed longwire runs 414 feet east-west, and averages 20 or so feet above the ground, a modest setup indeed. But, contrary to what all the books say, I don't experience RF in the shack, as would be expected from an unbalanced antenna, but this is probably because of the way I feed it.

The radio output, either direct or through my linear (after low-pass filtering), runs through a simple random wire tuner (L/C "Box"), and then out the window for about 100 feet on RG8 coax. The antenna, covered with #12 wire PVC, takes off from the center conductor of the coax, and terminates in an insulator which is tied off to a bush, with nylon line. The antenna starts at the rear peak of the house, crosses the backyard in the clear, and then disappears into a forest to the east. Fully three-quarters of the antenna is literally "buried" in the forest, which slopes down into a rather deep gulch. I consistently receive amazing signal reports from the U.S. mainland and South America.

The coax itself is air RF choked at both ends, just past the random wire tuner and just before the feed point, with six turns of the coax wrapped tightly to a diameter of six inches, taped together. I clamp quarter-wave counterpoise wires for all of the bands to the braid side of the coax at the feedpoint, and fan the wires out on the roof.

In the directions of the primary lobes of the antenna, it beats my dipoles, my R5, and horizontal-half-wave inductively-loaded "baby" loops. And it's inconspicuous—towers/beams etc. are not allowed in the planned community on Oahu where I live. On 10 meters, for example, when the background noise level is very high, as it is now as Cycle 22 takes a swan dive and few stations are heard, I have been told by hams on the mainland that my S9+ signal is a "real crusher."

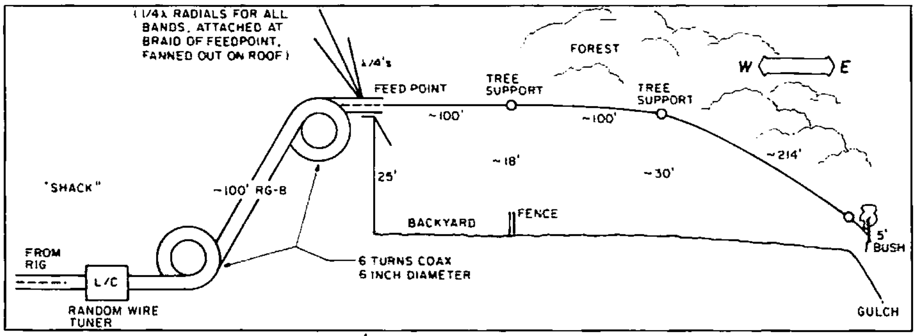

Figure. NH6XK's longwire antenna (414' east-west).

With a wire this long, the antenna impedance will be on the order of 500 to 600 ohms at average heights above ground. This presents a mismatch of about 10- or 12-to-one at the radio. But via the tuner in my TS-440S (balun about 3 or 4 to 1) and the L/C box itself (another 3 or 4 to 1), the mismatch is easily compensated for, e.g., 3:1 x 4:1 = 12:1.

Pertinent data concerning my antenna is given in the sidebar.

Recall that a gain of 3 dB is equivalent to doubling your power; 6 dB gain is a double-double, i.e., 100 watts becomes 400 watts; and a 9 dB gain is a double-triple, or 800 watts equivalent for 100 watts.

You don't need this much wire (414 feet) to realize gains; I just happen to be fortunate enough to be able to put out this much. Even a modest 68 feet will give you some gain over a dipole, and access to four bands.

Here are longwire lengths which I have tried, with their expected performance:

Length (Feet)	Bands Covered (Meters)	Gain (dBd) on 20 Meters
68	10, 15, 20, 40	1/2
137	10, 12, 15, 17, 20, 30, 40, 80	1-1/2
206	10, 12, 15, 17, 20, 30, 40, 80	2
275	10, 12, 15, 17, 20, 30, 40, 80, 160	3
372	10, 12, 15, 17, 20, 30, 40, 80, 160	4-1/2
414	10, 12, 15, 17, 20, 30, 40, 80, 160	5

NOTE: Gains will be in excess of these figures on higher frequency bands—as you have more waves on the wire, the shorter the wavelength. The converse is true of lower frequency bands.

The Figure shows how I have set up my longwire.

The bottom line is that if you are looking for a simple antenna which will cover all the bands, costs next to nothing to make, and has gain and directionability, a simple longwire may be hard to match, except by two of them (called a rhombic), of course. And there's no need to be put off by admonishments that you'll get "RF in the shack"—just choke off antenna currents as described.

If you've never tried a longwire, you have missed an opportunity to discover how simple and inexpensive an antenna can be, and still be very, very effective. 73

NH6XK's Longwire Antenna

Band Meters	Number of Full Waves on Wire	Horizontal Angle Of Major Lobes, From Wire Axis, Degrees	Radiation Angle, Degrees	Gain dBd
10	12	15	18	9
12	10-1/2	16	23	8
15	9	17	27	7
17	7-1/2	18	30	6
20	6	20	30	5
30	4-1/2	22	30	4
40	3	28	30	3
80	1-1/2	42	30	2
160	7/8	57	30	1

Wideband RF Baluns

A practical guide to the perfect match.

by Carl Markle K8IHQ

Amateurs who have been in the hobby for a few years know that many articles have appeared in various magazines and publications describing balun RF transformers. Much of this material has been written with very little practical applications information. Most articles either contain just enough information to allow the reader to construct (monkey see, monkey do), or go to the other extreme and include involved mathematical and theoretical explanations. Most readers want middle-of-the-road information with appropriate references to answer the more technical or application-type questions.

This article will answer some of the basic questions: What is a balun transformer? When does an application require a balun? How do you construct an efficient balun transformer? Where can you purchase component parts? I will also provide cost, performance, and technical information.

What is a Balun?

The word balun is an acronym describing a transformer. The letters "bal-un" stand for *bal*anced-to-*un*balanced impedance matching. This is to say that either the balanced or unbalanced windings may be used for input or output; the device will match unbalanced-to-balanced or balanced-to-unbalanced devices. Applications might include coax-to-ladder line, antenna arrays, and multiband antenna systems. The ratio required for a given application can be from 1:1 up to 1:16.

When to Use Baluns

The most obvious use is in matching a 50 or 75 ohm coax transmission line to an antenna system. This is especially true if it is a multiband antenna system.

One example is when connecting to a center-fed dipole antenna with a 1:1 ratio balun. Both sides of the dipole will provide equal half-power RF lobes, thus providing an undistorted figure-eight pattern. The second advantage of the unbalanced-to-balanced match in this situation is minimization of the TVI interference caused by the radiation of the coax shield instead of the dipole antenna. You will also notice that the SWR meter will start telling the truth about the actual standing waves present on the coax. Regardless of what is said, a low SWR is desirable because it ensures against high RF voltage breakdown on the coax line. It also gets all the RF power to the radiating antenna system, not allowing the feedline to radiate. In the chapter listing coax cable losses, *The ARRL Antenna Handbook* explains that the foam-type coax cable has very low breakdown voltages, which is not the case with the solid types. Some of these values are as low as 600 volts.

When using baluns at low frequencies, from 1.8 through 7.0 MHz, it is obvious that a coax-type balun would be physically very large and heavy and not practical. The second type of balun to be considered is the air-wound type. Because of the large number of turns required, it too would be a very poor choice. The most practical choice to cover this frequency spectrum is a ferrite or iron core wideband RF transformer. This core could be either a rod or the toroidal type. These types of baluns are the most practical type of matching device for transmitting uses to match the antenna to the transmission line. This is particularly true when multiband, i.e. 160, 80, 40 meter operation, is anticipated. It would be quite difficult, if not impossible, to mount an antenna tuner between the transmission line and the antenna. The remote tuning system would be expensive and very difficult to use because it would require retuning on each band before using. The wideband RF balun transformer is the most practical solution to this problem.

When selecting an appropriate core, consider its A_L factor (the inductance index) since the higher the A_L, the less the number of turns that are required to provide the inductance necessary at 1.8 MHz. Again, the use of a rod or toroidal core is a matter of the builder's choice. I chose the iron toroidal cores over the ferrite rod and toroidal types. The T-200-2 (2" o.d.) type of iron core is a good choice because it has an inductance index (A_L) of 49 and a permeability (μ) of 10.. With 14 turns of AWG14 magnet wire, the center resonant point falls into approximately 3.5 MHz, where 10 turns falls in at about 15 MHz.

The difference between iron and ferrite is usually only two turns, and certainly not a good trade-off in favor of ferrite. I discourage using ferrite because tests have proved that if high SWR occurs, heating of the core will also occur. High power core saturation can also cause heating of the core. If heating

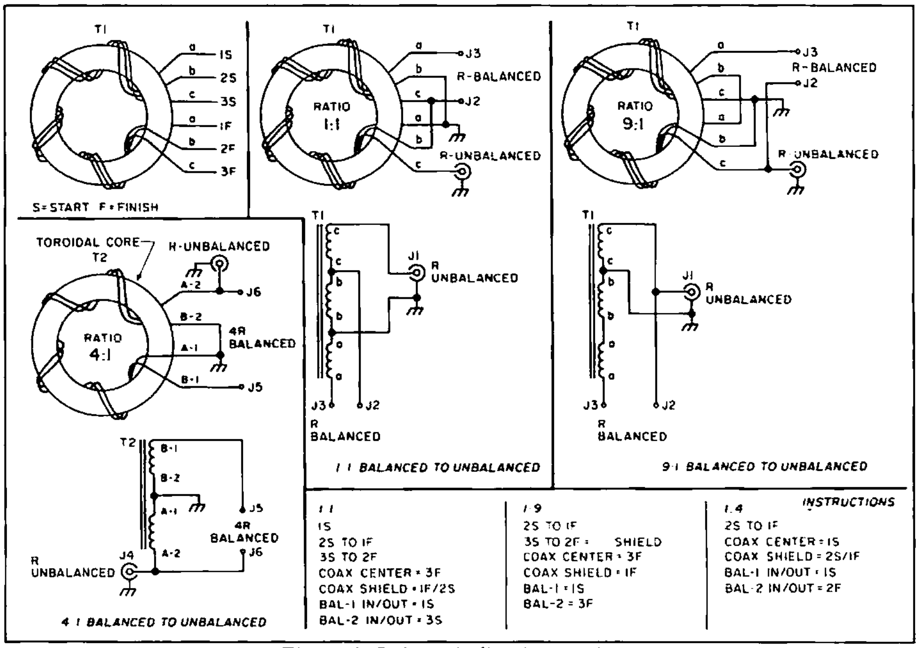

Figure 1. Balun winding instructions.

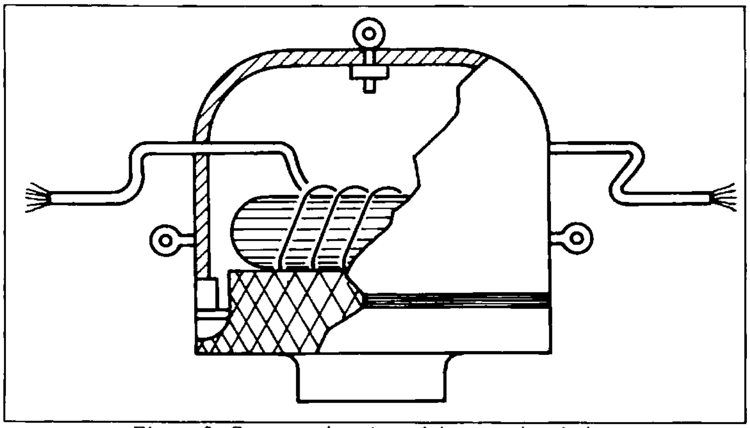
Figure 2. Cutaway drawing of the complete balun.

occurs on an iron powder core, the core will recover after cooling, whereas the ferrite will change $A_L(\mu)$ and not ever recover. Another consideration is that ferrite is very fragile and is prone to break if physically stressed (dropped to the ground during installation or damaged by a storm). Even water build-up can damage or fracture the core if it freezes in cold weather. Hairline cracks, visually hard to detect, can cause considerable performance problems. Also, note that ferrite is electrically a nonlinear material, very unlike the linear powdered iron cores. In general, I feel that ferrite should not be used for outdoor or transmitting applications.

Again, when to use baluns depends on the application. Practical winding ratios are 1:1, 1:2, 1:4, 1:6 and 1:9. If a ratio of 1:16 is needed, two 1:4 devices should be used. Table 1 lists some situations where baluns are necessary.

I highly recommend using these balun transformers to match line-to-load impedance differences (high SWR) over the 1:1 through 1:9 range if you expect maximum efficiency and power transfer. The second consideration is that unbalanced lines/loads can be matched to balanced lines/loads over a broad frequency range without tuning out the impedance differences which usually exist over a broad frequency range in a high Q situation. Since the balun is a low Q broadband device, there will be no large impedance differences caused by the change of frequency. This subject has been covered in many ham magazine articles.

In comparing the use of toroidal baluns from 14—50 MHz, the only construction difference is that 10 turns of AWG14 are required, although 14 turns would not be objectionable up to 30 MHz. The 10 turns of AWG14 enameled magnet wire on a T-200-2 (μ=10) core provides a center frequency of approximately 15 MHz. Of course, this is what is desired for 80 through 10 meters, the bands of most interest. This is the ideal balun to be used to match 50/75 coax to a 136'l off-center-fed multiband Windom antenna. Complete coverage on 80, 40, 20, and 10 meters can be used without an antenna tuner. Multiband quad-driven elements can be driven from one balun, thus making only one coax cable necessary to feed the system.

Don't forget that 50-ohm coax is usually fed through a short Q-section of 75-ohm coax to form a single frequency 1:2 balun for quad and delta loop antenna designs. Use of a 1:4 balun to feed all driven loop elements at once will result in no coax balun and a single coax feedline.

Multiband verticals can be made that don't require tuning when using a toroidal balun. Windings can be made to make unbal-unbal configurations useful in feeding verticals with multiband capability built in.

How to Build It

How is always the place where the true amateurs and the appliance operators separate. Most appliance operators will become ham operators sooner or later. The idea is that practical, easy-to-follow instructions, reasonable cost, and readily available materials must be used to encourage construction attempts by inexperienced hams. They must have the fear of failure reduced to a minimum. That is the objective of this article. This project should not take the novice more than a weekend to complete, so it will encourage the amateur to take on more difficult projects.

Schematics and pictorials of the three most popular baluns are provided. There are no critical or tricky items involved. If you just plain follow the instructions, success will follow. Decide on one of the projects and wind the proper ratio for the application.

Parts Sources and Prices

Where to purchase parts? I am sure that there are as many sources of materials as there are varied prices. There are handling/shipping charges, taxes, etc. This type of aggravation has caused many a do-it-yourselfer to just put his hands in the air and give up. I have been tempted many times myself. But, as a very determined person, as well as a ham from the vacuum tube days, I take great pride in displaying home-brew items which perform as well as those expensive imported items.

Costs? The bill for the materials will be the same regardless of what ratio or configuration you choose. It is important to use one of the sources listed below, since all manufacturers do not produce the item in the same physical size. Bargain store or hamfest parts could take all the fun out of the project. A list of sources and relative costs are included in the Parts List.

Testing can be done by connecting a 100W electric light bulb to the balanced output. Connect the transmitter to the balun coax input. Apply less than 100W of RF power at 7.0 MHz and observe the light bulb lighting up. Ensure that the SWR indicates less than 2:1 using 17 feet of coax feedline or less. Two or more of the baluns, regardless of winding ratios, can be connected back-to-back in conjunction with a standard 50 ohm dummy load to check SWR and performance at the 1 kW power level. SWR should read 1.3:1 or less during this test. Always test the feedline connected to the dummy load or 100W light bulb to insure that the line is good and there is an SWR of 1.0:1.

Construction

Always consider the high RF voltages which might occur if the SWR gets greater than about 3:1. This high voltage can break down between windings or short out to the iron core. Follow these steps:

1. Wind the T200-2 core with glass tape. Make sure that all the surface is covered. Overlap the tape slightly to insure that adequate coverage is present.
2. Even though it's not necessary, I always spray the core at this point with polyurethane. Any brand, such as Varathane, may be used.
3. Take all two or three (3 feet each) lengths of #14 AWG magnet wire and simultaneously wind all three wires: 10 turns for a 15 MHz center frequency or 12 turns for a 3.5 MHz center frequency.
4. Configure the windings for the desired ratio as outlined in Figure 1.
5. It's not necessary, but I always spread a little RTV insulating gel between the winding connections. This insures against high voltage breakdown between windings. Additional glass tape could be used instead of the RTV compound.
6. Prepare the S0239 receptacle by soldering two 6" wires to the center and shell of the connector. Place RTV compound freely around the back side of the connector. Place the connector into the 1-1/4" bushing. Allow about one hour for the RTV to set up.
7. Place the S0239 connector/bushing assembly in the 2" reducer. Coat the surface with PVC cement or other adhesive. A thin coat of RTV may also be used for this purpose, although the cure time is quite long.
8. Place this assembly face down and level. Pour the rest of the epoxy into the rear of the assembly. Bring the level up to the lip of the 2" reducer. Now take the prepared balun transformer and place it into the epoxy on top of the 2" reducer assembly. When the epoxy cures the balun will become permanently attached, thus forming an assembly.
9. When the assembly has cured (approximately two hours) you will be able to handle it. Strip and attach the SO239 wires to the correct windings by soldering.
10. Attach the other two 12" #14 insulated wires to the proper windings again with solder.
11. Drill 1/8" holes at the top of the cap to

Table 1. When to Use Baluns

1:1	Unbal-Bal	Matches 50 or 75 ohm coax to center-fed dipoles and 2-element quads.
1:2	Unbal-Bal	Matches 50 or 75 ohm coax to multi-element quad and yagi antenna systems.
1:4	Unbal-Bal	Matches 75 ohm coax to 300 ohm twin-lead and off-center-fed multiband Windom antennas. Also, they can be used in low frequency antenna stacking arrays.
1:6	Unbal-Bal	As in (3), except for 50 ohm coax.
1:9	Unbal-Bal	Matches 50 ohm coax to 450 ohm open ladder line. Provides an extremely low-loss transmission line for antenna arrays from 15 to 50 MHz. (See Figure 2.)
1:1.5	Unbal-Unbal	Matches 50 ohm coax to vertical antennas.

allow the 12" balanced wire connections to exit the housing.

12. Cut a piece of the #14 AWG insulated wire to fit around the edge of the 2" reducer. This will form a gasket seal when the cap is placed over the balun assembly.

13. After electrically testing the balun for correct operation, place the assembly together. Bring the insulated wires through the cap exit holes. Force the assembly into the cap. Place the insulated wire gasket between the cap and assembly. I recommend using PVC cement to help provide mechanical strength.

14. Place the assembly in a vice, carefully squeezing it together. Finish drilling the 1/8" holes into the assembly, being careful not to drill into the connector. Only epoxy and PVC is removed.

15. Drill one hole at a time, screwing the eye hooks into the housing. This provides a weatherproof assembly. Suspension is generally by way of the antenna system, i.e. dipole wire. The balun acts as a center insulator in this case. The coax (RG58A/RG59A, etc.) will make the assembly hang properly when suspended. The coax connection will then be protected from the weather.

Note: In the case of 1:9 baluns used as 450 ohm ladder line transformers, the ladder line connects to the eye bolts and the coax will provide the required in-line mechanical support.

I recommend that the unit be sprayed with polyurethane to protect it from ultraviolet ray deterioration. This is not necessary, but it is desirable. Unprotected, the housing will last in excess of seven years.

Refer often to the figures and instructions to keep from making a mistake. Mistakes in winding connections can be corrected with less difficulty before final assembly. An ohmmeter should be helpful in determining the beginning and ending of the various windings.

Again, the effort here is on practical construction and not on design information. Pick a project and build a balun or two. Applications include delta loops, quad loops, dipoles, slopers, G5RV(Zep), multiband windom dipoles, low-loss coax to ladder line transformation, etc. 73

Contact Carl Markle K8IHQ at 8385 Locust Dr., Kirtland OH 44094. Please enclose an SASE.

Parts List

Item	Description	Part No.	Qty.	Cost	Source
Toroid core, 2" o.d.	iron powder (μ=10)	T200-2 (1 kW) T200A-2 (2 kW)	1	$3.60 $4.25	Amidon, Palomar
5"-wide electrical tape	glass cloth	Scotch (3M) #27	2'	$4.50	Amidon—66' roll
AWG-14 magnet wire	9' (2kV)				
	thermoleze	wire	9'	$0.90	Amidon
Coax conn.	receptacle	SO239 (flange)	1	$1.29	Radio Shack, Hosfelt, hamfests
Eye hooks	NI-CAD 3/16	none	2	$0.26	local hardware store
AWG-14	PVC strand	insulated			
	stranded	machine wire	3'	$2.00	local auto store ($2.00 per spool)
Epoxy	epoxy resin	FHR4	1	$4.95	local auto store Permatex 1-pt.
1.25" x 1.5" bushing	white PVC plastic	Univ. No. 437-167	1	$0.65	local plumbing store; NIBCO or Colonal only
2.0" x 1.5" DWV reducer	white PVC plastic	Univ. No. 4801-2F	1	$0.69	local plumbing store; NIBCO or Colonal only
2" DWV domed cap	white PVC plastic	Colonal 447-020	1	$0.86	local plumbing store; Colonal only

Sources:

Amidon Associates, 12033 Otsego St., Hollywood CA 91607.

Palomar Engineers, P.O. Box 462222, Escondido CA 92046.

Radio Shack/Tandy: Local stores; Part No. 278-201.

Hosfelt Electronics, 2700 Sunset Blvd., Steubenville OH 43952.

NiCd Restorer/Charger

Don't throw old NiCds away!

by Ed C. Miller N7APE

Amateurs have about the same battery-powered devices around the home as most other people. But we also have numerous pieces of ham equipment, test equipment, and other electronic gear that use rechargeable NiCd batteries. Around my shack, most of them are either C or AA cells.

Recently, I rounded up all the NiCd batteries I had that wouldn't take a charge. Seven of them were C's. It was time to build a NiCd restorer/charger. The circuit in Figure 1 restored all but one of the batteries (it had an internal open condition). Most of them were restored in an hour or less, except for one with an internal short, which required four hours.

Why NiCds Won't Charge

NiCd batteries stop recharging because small bits of metal slough off inside the cell and become lodged between the battery's plates. This causes the cell to short. To restore the battery, the short must be removed.

The restorer/charger does just that: It breaks down the internal short by briefly applying high current pulses to the defective battery. When the short is removed by this action, the unit becomes a standard charger. Since it becomes a charger at the right time, all you have to do is insert a C or AA battery and come back 24 hours later. In most cases, you will come back to a fully charged and restored battery.

A Straightforward Circuit

Twelve VDC is applied through a 47 ohm resistor to the parallel 2200 µF capacitors. U1a monitors the rising voltage on the capacitors. At a prescribed level of charge, U1a fires the SCR, discharging the capacitors through the power transistor into the defective battery.

When the discharge is complete, the procedure is repeated. U1b monitors the average voltage at the battery terminals, and when it exceeds about 0.3 volt, the SCR is switched on continuously to produce about 150 mA of steady charging current.

Although the restorer was intended primarily for C size cells, you can also use it for the AA size. The charge current is suitable for a standard charge of the C size and a quick charge of the AA size. Charge time for AAs should be about five hours. For C's, charge time is 24 hours, as noted above.

PC layout is generally not critical, but it's important to keep the charging current path resistance low. Using wide traces on the board and reasonably thick wire to the battery terminals helps accomplish this. Although the current pulses applied during restoration are of very short duration, they may exceed 20 amps.

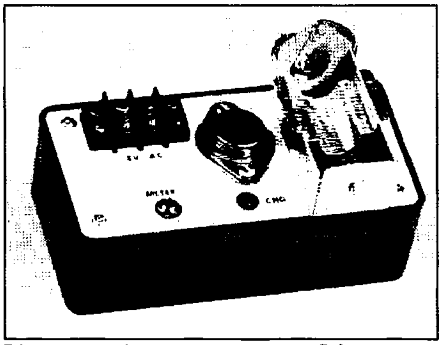

Photo A. The home-brew NiCd restorer/recharger can save you money.

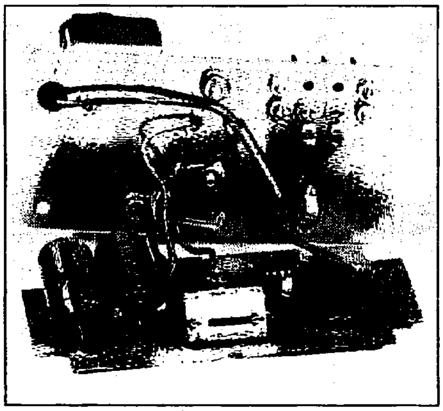

Photo B. Inside the charger/restorer.

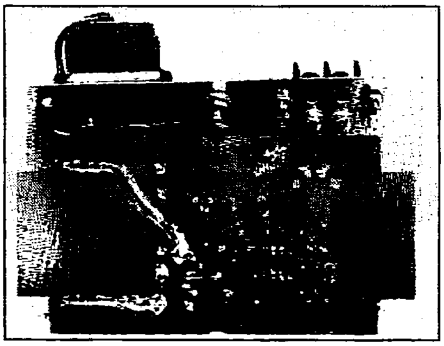

Photo C. From beneath, showing the soldered PC board.

Components and Parts

Easily obtained components are used throughout, and none of them are particularly critical. An LM358 is used as a dual comparator: The output of U1a goes positive when C1 and C2 are nearing full charge, enabling the SCR, and in turn the pass transistor, which discharges C1 and C2 through the battery.

Section U1b compares the average battery voltage with the reference set by R13. When this voltage exceeds about 0.3 volts, the output of U1b goes positive, locking U1a ON, and lighting the LED. In this condition, the battery is on a steady charge. The charging current is determined primarily by R1 and the supply voltage under load.

Almost any high current NPN power transistor may be used for Q1. Although an ECG-181 provided slightly more burst current, the circuit worked very well with a 2N2055 and an RCA 40411. The SCR should be a sensitive gate type, and have characteristics similar to the GE 103 series.

I used a standard 1.75VA, Class 2 utility transformer rated at 6—8 VAC, but the unit may also be powered by a DC supply of 10—15 volts with a current rating of at least 100 mA. It is best that the voltage across C1 exceed 8 volts under load (i.e., with C1 and C2 shorted). Of course, somewhat higher AC or DC voltages may be used if only C and D

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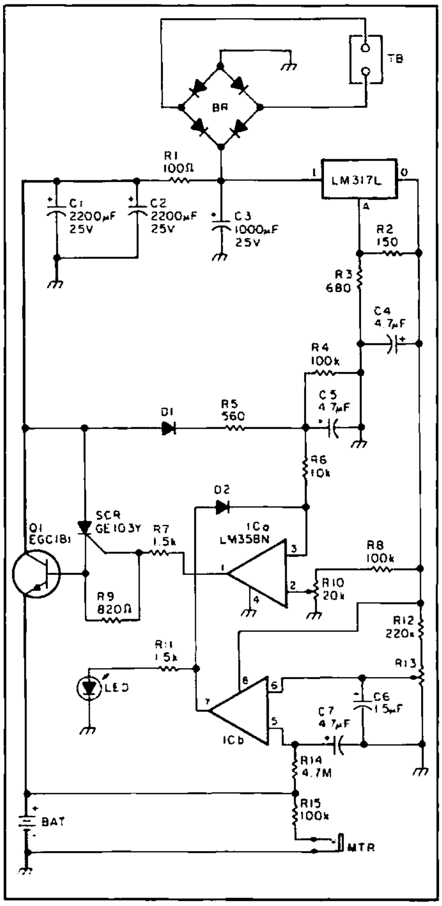


Figure 1. Schematic for the NiCd restorer/charger.

73 Review

The Comet CX-224 Triband Mobile Antenna

by C. L. Houghton WB6IGP

NCG
1275 N. Grove St.
Anaheim CA 92806
Telephone: (714) 630-4541;
(800) 962-2611
Price Class: CX-224 Triband Antenna: $80
CFX-324A Triplexer (with leads: $100; w/o leads, CFX-324B: $95)
RS-21 Mobile Mount: $30
3D4M; 13.5 feet of low-loss coax w/ connectors: $23

Operate 144, 222 and 440 MHz with one antenna.

I have tried several different types of antennas over the years and have at times been quite pleased with their operation. I was not aware of a triband VHF/UHF antenna on the market until I heard about Comet's new triband mobile antenna, the first on the market as far as I can tell.

I set several goals for evaluating the Comet triband mobile whip antenna. First, what improvements were made by Comet in comparison to the basic mobile antenna in use today? Second, what advantages or disadvantages were noted during the evaluation test period? Third, how sturdy is the construction and what is the longevity of the product? Will it hold up to the weather and to mobile operation? With those main questions in place I set out with an open mind to evaluate Comet's new three-band antenna.

Installation

My installation consisted of the CX-224 Comet antenna, along with their RS-21 Prestige trunk and hatchback mount, and their CFX-324 Triplexer (Model CFX-324A has coax UHF connectors with leads, and Model CFX-324B is terminated in UHF connectors). In actual use the triplexer is not necessary if you intend to use only one band at a time. In a single radio mode all you have to do is switch the coax cable to the other transceiver.

With the triplexer the coax cable can be attached to each individual radio or to each input/output of a three-band radio. It worked superbly on all bands with the triplexer and triband antenna. My three single-band HTs were used singly and in concert with each other when I switched to the triplexer for mobile operation. It was quite something having the triplexer and operating on all three bands at the same time: 144, 222, and 440 MHz.

To those not familiar with a triplexer, it's a passive bandpass filter with individual coaxial ports for each band and one combined output to connect to your antenna system, in this case to the three-band antenna. There are three frequency ranges for the Comet CFX-324 triplexer: Input 1 is rated for 1.3 to 150 MHz; Input 2 for 200 to 320 MHz, and Input 3 for 390 to 500 MHz. Power handling capability for the unit is 600 watts PEP, and the VSWR was less than 1.5 on all bands. Loss through the triplexer was also very low.

Since the Comet antenna is a single antenna resonant on all three bands (144 MHz, 222 MHz and 440 MHz) the triplexer and antenna are a natural pair. Operation can be carried out with three different radios, each connected to and operating on the same antenna at the same time. Transmit or receive, it does not matter how you use it. That's the concept.

Road Test

I decided to try this out in actual operation. In my test I used my normal mobile radios, all single-band handie-talkies on the 144 (2 meters), 222 (1-1/4 meters) and 440 MHz (3/4 meter) bands. See the Figure for details.

The antenna mount was positioned on the luggage rack of my station wagon. A comparison antenna (quarter-wave) was mounted on the other side of the car for each band, one at a time. In test comparisons on 2 meters (146 MHz) the antenna showed about 2 dB gain over the test antenna. On 1-1/4 meters (222 MHz) gain was slightly higher, just over 3 dB, and on 3/4 meters (440 MHz) gain was noted at just over 5 dB. The gains may have actually been slightly higher, considering connector wobble during the test, switching and timing between measurements. Also, I did not have attenuators in fractional values to exactly duplicate results, so I had to settle for 1 dB increments. In any case, performance was as advertised in this portion of the test.

On transmit I measured the system SWR which was quite flat (1.5 to 1 SWR) over each band. I have seen dual-band antennas before and tried to construct one (which, by the way, is quite tricky to get working right.) But for a three-band antenna to perform so well and be matched throughout the band, to say I was pleasantly surprised is quite mild! I was very impressed with Comet's antenna and their attention to detail. I was skeptical at first, trying to keep an open mind, but after lots of mobile operation it proved to be a real joy to use.

The setup is nothing—there are NO adjustments to make. There's no element to change length—just screw the base of the antenna onto its coax feeder/mount and you are ready to go right out of the box. Quite impressive! Comet really did their homework for us in making the antenna "goof proof." In extended operation with the triplexer no degradation in signal performance was noted, with three different frequency radios connected all at the same time (my HTs), and the large triband rig.

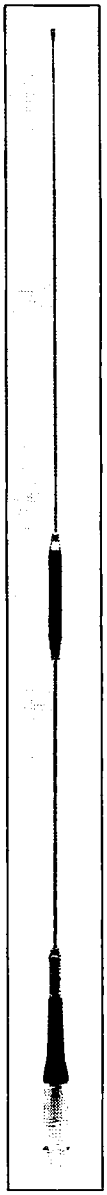


Photo. The Comet CX-224 triband mobile antenna.

I suppose, in the case of my HTs, you could give a different radio to two other amateurs in your car and all operate at the same time. Normally you would operate on one frequency and monitor or scan the other bands. This mode worked very well in practice and allowed me to keep up with several frequency-hopping friends. I did test two radios at one time and did not notice any interaction or degradation ever, even between the 2 meter and its harmonic-related 3/4 meter radio (simultaneous transmit and receive). There was no apparent loss of sensitivity on one band while transmitting on another band.

Lots of Good Points

There are so many applications, advantages and improvements it's hard to know where to start desribing them. First, the ready-out-of-the-box aspect makes a vast difference. Operation with the triplexer is so easy it requires no intervention to start operation—you just connect the coax cable.

How sturdy is the system? Well, the mechanical construction of the antenna is quite durable and has handled its brushes with low-hanging tree limbs quite well. The antenna is well made and should have a long life, even with some harsh treatment, and should survive even bad weather for a long time. All elements to tune the antenna are sealed in a plastic/epoxy molded enclosure around the main element, also very strong.

All exposed metal used in the antenna is stainless steel. The mount only was covered with a hard black enamel finish. The hardware is very substantial, making it a rigid mount.

The trunk hatchback mount was adaptable and easy to apply to many different surfaces of my station wagon. All you need is a thin metal strip, like the top of your auto door or trunk lid, to fasten the

Continued on page 28

Comet Three-Band Antenna

Continued from page 26

mount. It has four Allen screws to fix it securely. The big advantage to this type of mount is that it's a real wife-pleaser, a no-hole installation on your car. I managed a no-scratch mounting demonstration for my wife! The mount is provided with a pad to prevent scratches on the car's finish when mounting or removing it.

The bottom surface is where the four Allen-head screws fix the mount to your trunk or door. For a trunk application, the mount is normally positioned straight up in all adjustments. If you took the mount off the trunk and mounted it on the door the antenna would be horizontal. However, by a simple adjustment on the multi-angle mount you can right the antenna to vertical in moments. As I said, very versatile.

The antenna can be removed quickly with a few twists from the mount for theft prevention when parking your car. I usually place external antennas inside the car's trunk to keep them out of sight. For all-day parking, a mobile antenna on display is a red flag for someone on a "shopping spree." Placing it in the trunk and out of sight took only a few seconds.

Another feature that took me by surprise was the base-to-antenna-mount portion of the antenna itself. It is connected to an internal spring-type mechanism that permits the antenna to be folded over in a hinging action. It does not disconnect at this joint but can be folded over in one section so you don't have to drag it through your open garage door. Fold it over and then just park in your garage—a nice additional feature from Comet.

My overall rating for this antenna from Comet is one of high marks in all categories. They have done an excellent job making three-band mobile operation on one antenna quite easy and cost effective. What seems to be a complex antenna system is actually very simple to put into operation. I feel this product was engineered and delivered to fill a real void, especially when you consider that you are getting one complete ready-to-use antenna system for the three prime VHF/UHF amateur bands in use today: 144 MHz (2 meters), 222 MHz (1-1/4 meters), and 440 MHz (3/4 meters). I highly recommend this antenna to anyone searching for a good system for these bands.

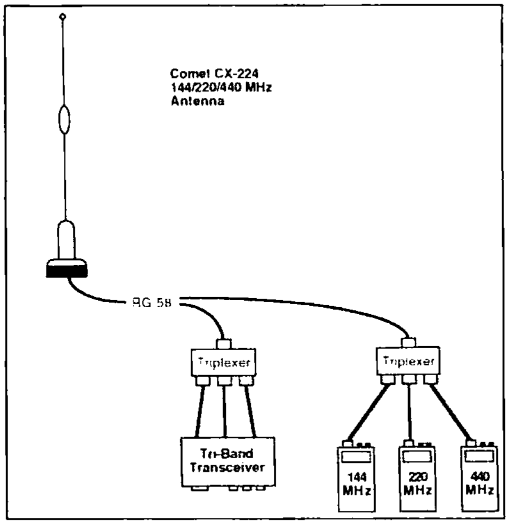


Figure. Comet's triband antenna with triplexer will feed one three-band radio or three individual radios, with one radio per band. All may transmit or receive at the same time.

NiCad Restorer Charger

Continued from page 24

size cells are to be restored or charged. It's important to limit the charging current to the maximum recommended for the cell size.

The battery compartment was made from aluminum, with a small aluminum insert for use with AA size batteries. If the builder wishes, a commercial holder for a C, and one for an AA (wired in parallel), can be used instead.

The LM317L low current voltage regulator powers the op amp, as the supply voltage fluctuates considerably while C1 and C2 are being charged. Without the regulator, the op amps might lose some of their stability.

The two mini-pots may be replaced with 18k ohm resistors if the power transformer is equivalent to the Western Electric 2012A.

Any case will do. I used a stock Radio Shack item.

Adjustments

There are only two of these, and they are interrelated. R10 sets the bias on U1a so that its output will go positive just before C1 and C2 reach full charge. R13 is set to enable U1b positive output when the voltage across the battery being restored reaches about 200 or 300 mV. A battery sustaining that voltage between restoration pulses is usually free of internal shorts.

Parts List

1	1 amp	bridge rectifier
C1,2	2200 uF 25V	electrolytic
C3	1000 uF, 25V	electrolytic
C4,5,7	4.7 uF, 15V	tantalum
C6	1.5 uF, 15V	tantalum
U1	LM358N	IC
1	standard	LED
Q1	ECG-181	or 2N2055 or 40411
U2	LM317L	regulator
R1	100 ohm, 2W	carbon
R2	150 ohm, 1/4W	carbon
R3	680 ohm, 1/4W	carbon
R4,8,15	100k, 1/4W	carbon
R5	560k, 1/4W	carbon
R6	10k,1/4W	carbon
R7,11	1.5k, 1/4W	carbon
R9	820 ohm, 1/4W	carbon
R10,13	20k	trimpots
R12	220k, 1/4W	carbon
R14	4.7 megohm, 1/4W	carbon
1	GE-103Y Triac	SCR

Misc.: Case, PC board, mini-jack (for meter), terminal strip, battery holder(s).

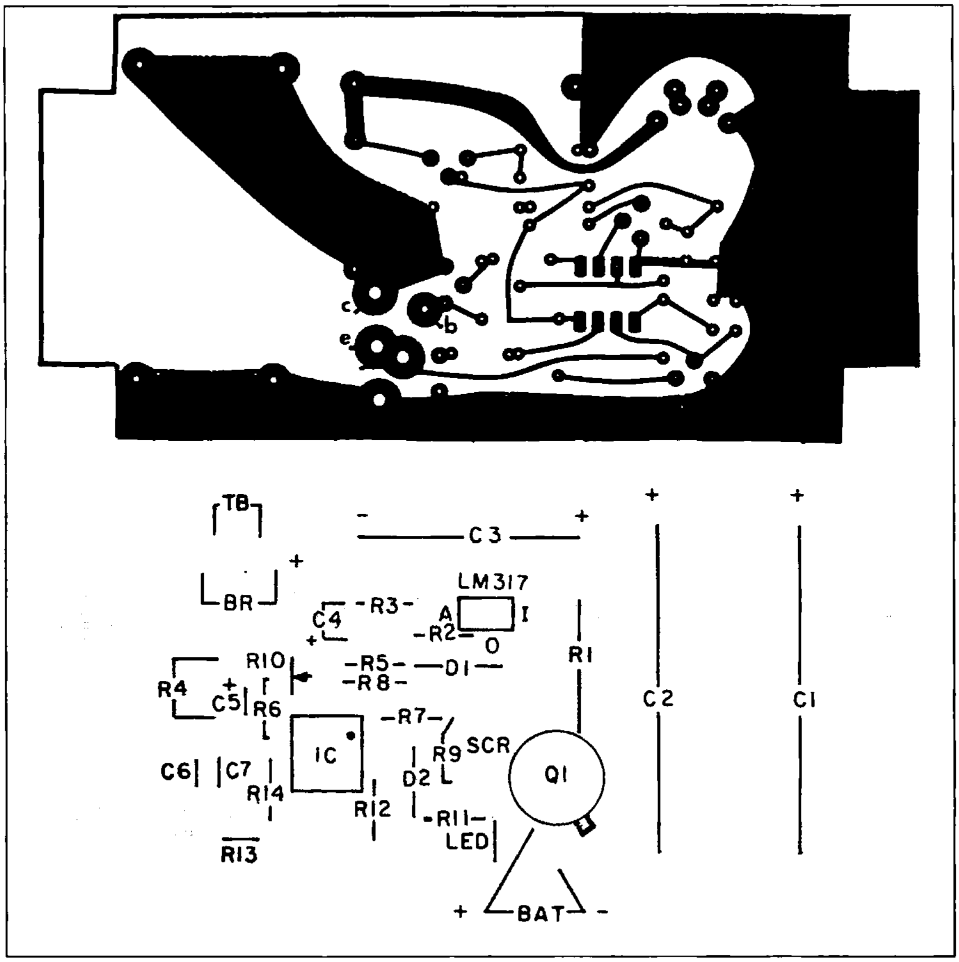


Figure 2. (a) The PC board and (b) parts layout.

High Performance 2 Meter Yagi

Improve your signal with this compact design.

by Bill Robertson W3HMI

It never ceases to amaze me that with 40 milliwatts of RF power into a yagi antenna, I could bring up a 2 meter repeater 30 miles away. But it happened. The report I got was of a "... raspy background but clear copy." Another incident that proves there is no substitute for a good antenna.

2 Meter Yagi Design

The antenna shown in Figure 1 has the characteristics listed in Table 1, which were taken from my old engineering notebook.

It is interesting to note that on the hand-drawn pattern of Figure 3, the E-plane pattern is skewed about 5 degrees off center. This skew is caused by the gamma matching element. The side of the radiator with the gamma element tends to be the side of the positive skew. Reversing the gamma element reverses the skew. When mounting the yagi vertically, it is best to have the gamma element on the upward side so the pattern will tend to point 5 degrees upward.

Super Portability

Transmitter hunters will find this antenna an asset because of its size, weight, mounting and operation ease. It can be mounted either horizontally or vertically.

After a look at Figure 1, it is evident that this yagi appears to be a little different from run-of-the-mill yagi antennas. The driven element is close to the reflector, and the reflector itself looks considerably longer than normal. The full size boom length is just under one wavelength.

The gain measured in the lab on a 20 to 1 model using a standard gain horn was 13.8 to 14.1 dBi over a 3 percent bandwidth. The beamwidth at the half power point is about 37 degrees in the E-plane (vertical plane, with the antenna mounted vertically), and about 42 degrees in the H-plane (horizontal plane). The VSWR (Voltage Standing Wave Ratio) with the gamma set as shown in Figure 2 is 1.5:1 or less at 145—148 MHz. You can get a larger bandwidth by changing some components in the gamma matching element. I have found that the combination shown fits my needs.

I always refer to this antenna as the "Stu Henderson Yagi," after the guru who developed all of its basic parameters, which he based on his original design for a folded dipole TV antenna. Stu spent many hours experimenting with this antenna design. My part in the design consists of the matching device and the construction technique.

Even though the antenna described here is for 2 meters, the same parameters work just as well for any frequency. See Table 2.

Wood or Metal?

The antenna and supporting mast are all metal with the tolerances held as close to within 1/16 of an inch as possible. Using metal for all the antenna parts does *not* affect the performance.

In several articles I have read lately, the beam antennas have wooden booms and masts. However, in most cases, the added protection of all-metal mast elements is worth more than the minor benefits of insulated booms and masts.

One of the things I measured in the lab on the models was the effect of metal with the antenna, vertically or horizontally polarized, mounted on the supporting mast. No measurable difference could be detected on the patterns or gain when comparing wood versus metal mast and boom element.

Making the Boom

The first and most important task is to correctly drill all the holes in the boom. See Figure 1. Getting this right is very important because it affects the accuracy as well as the appearance of the antenna. The boom requires 72-1/4 inches center-to-center from the reflector element to director number 3. Therefore, I had to purchase two booms because they only came in 72-inch lengths. See Table 3.

At the same store, I purchased a 1-inch diameter wooden dowel. A 3-inch long section of the dowel was wrapped with one layer of aluminum foil, and forced 1-1/2 inches in-

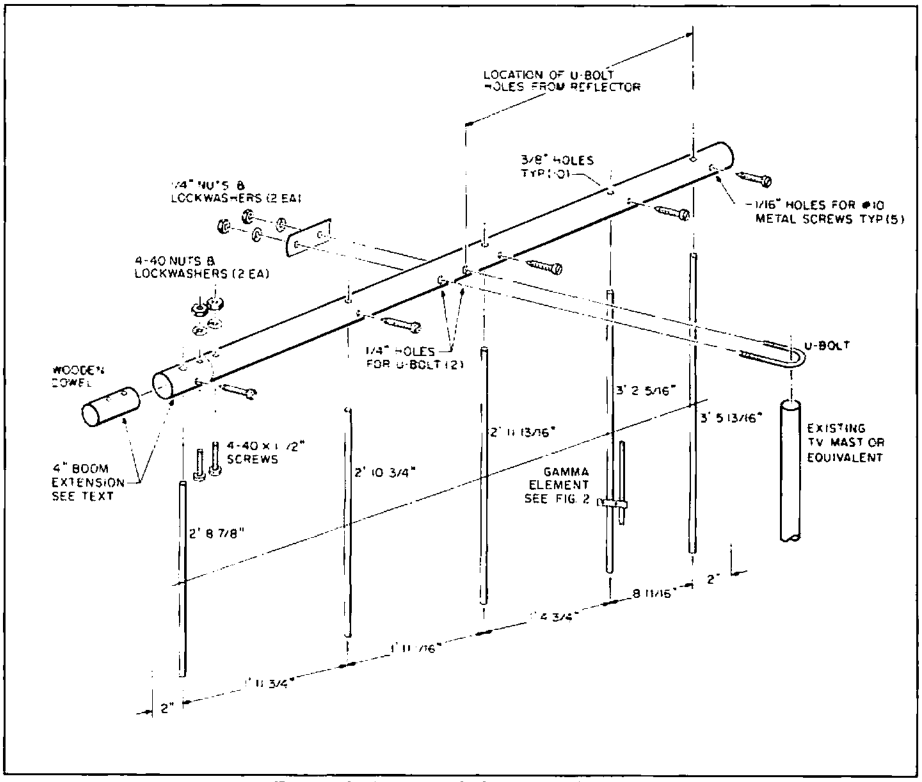


Figure 1. An exploded view of the yagi.

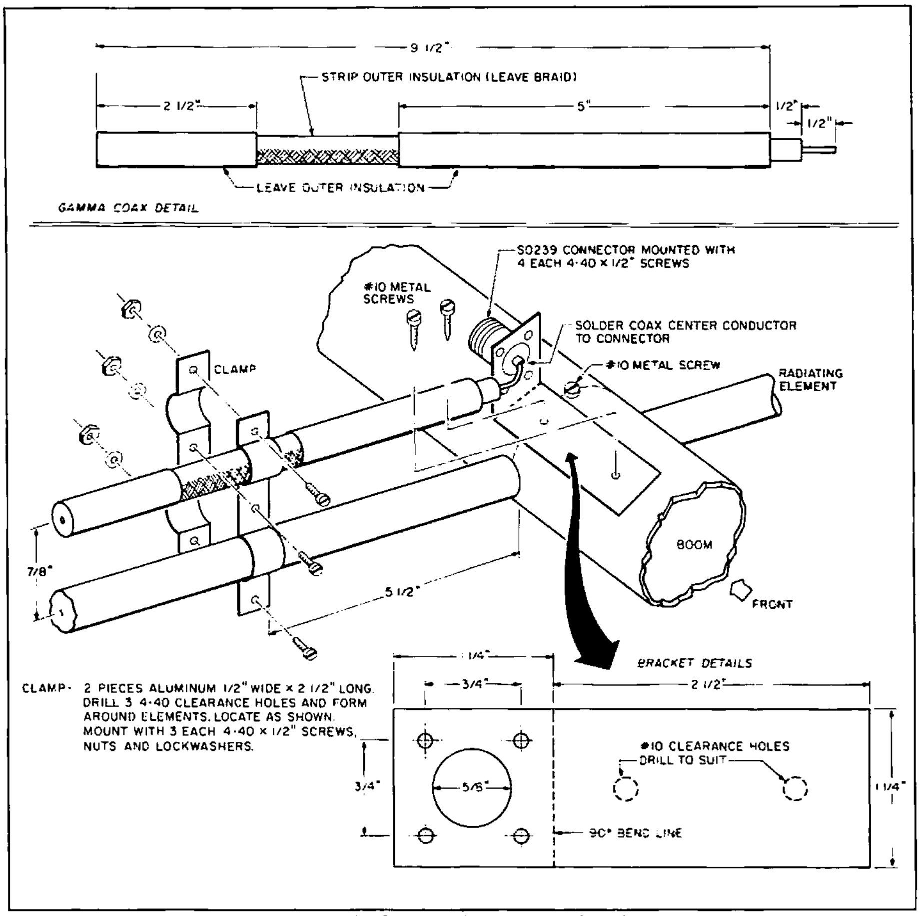


Figure 2. Gamma fabrication details.

side the 1-1/4-inch outside diameter aluminum tubing. This allows an extension to be made to the boom. I added a 4-inch piece, making the total length 76-1/4 inches. Two holes were then drilled through the metal and the wood for the two #4-40 x 1-1/2-inch screws. (Aluminum pipe in longer lengths is available at some stores.)

A bench vice was used to hold the boom in a fixed horizontal position. I used a plumb line to find the top point on both ends of the boom. Then I scribed a line running the length of the boom. Along this line I measured out the element spacing, and center-punched each one. Before punching, however, I double-checked each element spacing for an accuracy of as close to 1/16 of an inch as possible.

At each element measurement, I scribed a line around the boom diameter. If you use a drill press to make the holes, all this will be unnecessary. I used an electric hand drill, so I wanted to find the bottom hole as accurately as possible, and drill from both sides, rather than taking a chance on holding the hand drill straight.

To accomplish this, I cut a strip of paper and wrapped it around the diameter. With this strip of paper marked properly, I could accurately find each 180 degree point for every element measurement.

After marking the paper strip for one boom diameter, you just lay it out flat and measure and mark the halfway point. Then wrap it around the diameter, and the halfway mark will be the 180 degree point. After center-punching them, you can drill the holes. Using a 3/8-inch drill bit on the hand drill, I drilled each element from both sides of the diameter towards the center of the boom.

Next, I drilled the 1/16-inch holes at 90 degrees to the large holes for the #10 metal screws. These holes are for securing the elements once they have been installed. I located the proper 90 degree point with the same paper technique as before.

Now you can locate the U-bolt holes and use the same technique with the paper to center the 1/4-inch clearance holes. Drill from opposite sides again to get the holes straight.

Assemble the elements by cutting them to the correct length, as listed in the design parameters. I found it was easier to center the elements during installation by first measuring each element and marking the center point, then second, measuring from the center point in either direction 5/8 of an inch, and third, scribing a circle around the diameter of the element. Then you can push the elements into the 3/8-inch diameter holes, as shown in Figure 1, until the scribed circle is flush with the boom.

If enough care has been taken drilling the holes, you may be able to drive the elements in and not have to use the #10 screws to hold them in place. If the fit is sloppy, use the screws and tighten them until they touch the elements. (Flatten the screws on the tip with a file before insertion—this makes them fit against the elements a little better than a

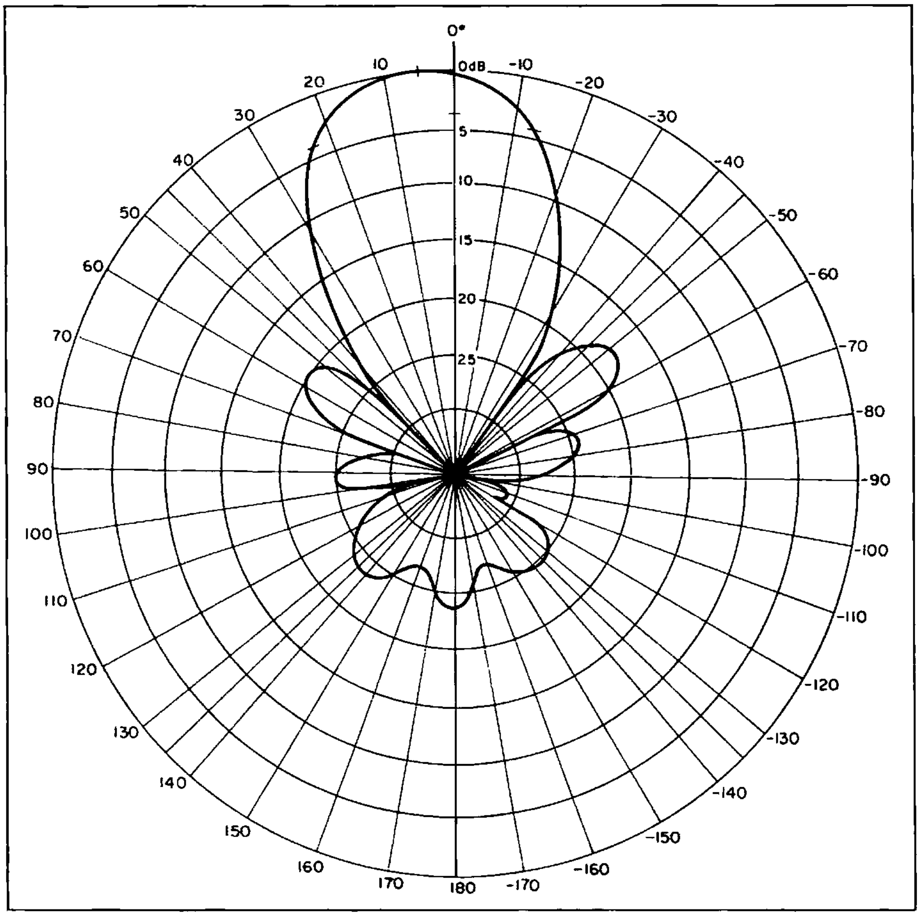


Figure 3. E-plane pattern sketch.

Table 1. Center Design Yagi on 146 MHz

Gain:	14 dBi
Bandwidth for 1.5 to 1 VSWR:	3 MHz
Beamwidth E-plane	37 degrees
Beamwidth H-plane	42 degrees
Front-to-Back Ratio:	Greater than 20 dB
Sidelobes:	Greater than 15 dB down
Length	76-1/4 inches
Weight	Less than 2 pounds

Table 2. The "Stu Henderson Yagi" for 146 MHz

Reflector length	= 509/f	3' 5-13/16"
Space #1	= 106/f	8-11/16"
Radiator length	= 466/f	3' 2-5/16"
Space #2	= 204/f	1' 4-3/4"
Director #1 length	= 436/f	2' 11-13/16"
Space #3	= 280/f	1' 11-1/16"
Director #2 length	= 423/f	2' 10-3/4"
Space #4	= 289/f	1' 11-3/4"
Director #3 length	= 400/f	2' 8-7/8"

Where f is in megahertz.

Table 3. Materials List for the 2 Meter Yagi

2	booms	1-1/4" dia., 76" long, 0.05" wall thickness
3	elements	3/8" dia., 6-foot long solid or thin wall
1	piece scrap	3" x 4", 1/16" thick

sharp point.) Double-check the fit by pulling and pushing on the elements. Tighten as necessary, but do not over-tighten, as this will distort the element and could tear the thin skin of the boom.

Gamma Construction

Fabricate the gamma parts as shown in Figure 2. The gamma is simple and very effective. The length of coax provides the series capacitance, and the slider provides the inductive adjustment. The combination provides the resistive component. Cut a 10-1/2-inch length of RG-8, RG-9, RG-213, or RG-14 cable. All will work because they naturally have a capacitance of about 29 pF per foot.

Trim two 1/2-inch segments at one end as shown in Figure 2, one all the way down to the center conductor, and the other through the outer insulation and braid. Cut the outer insulation only from a 2-inch section that will be in contact with the gamma slider. The total braid left on the coax piece should be 9-1/2 inches for about 23 pF series capacitance.

Fabricate the connector bracket and mount the SO-239 connector. Align the bracket on the boom at 45 degrees from the elements, and drill the mounting holes for the #10 metal screws. Solder the coax piece to the connector and mount the remainder of components.

Final Adjustments

Fabricating the antenna to the dimensions specified, and holding the tolerance to 1/16 of an inch, should get you very close to the design parameters. I moved the gamma slider in about 1/4 of an inch, and that is the only adjustment I had to make on the first try.

For the VSWR adjustments, I mounted the yagi on a 10-foot section of TV mast and leaned it against a 4-foot chain link fence. This allowed me to make changes easily. I then mounted the yagi on an existing TV mast and measured the VSWR again. One adjustment of about 1/8 inch was all I needed, and I was close enough on the second try.

I think the yagi is an easy antenna to build. I have built at least 10 antennas for different frequencies, plus all the models during the design phase in the antenna lab.

The total cost for the antenna, including the connector, U-bolt, and all hardware, is less than $30. If you also buy a 20-foot mast, a roof support bracket, and 50 feet of coax with two connectors, the cost is still less than $70. You can buy the necessary materials, hardware, and connectors at most hardware stores and Radio Shack.

Less expensive methods for mounting the antenna are available. One economical approach is to use two chain link fence rails as masting, and a roof bracket. The rails are 10 feet long, interlock with each other, and are about $6.00 each. The roof bracket can be installed to hold the rails at the roof level. On most houses there will still be adequate antenna space on the mast above roof level.

The yagi described here will work well if fabricated to the specified guidelines. Many variations can be applied, and the results would be just as good or better. Don't hesitate to experiment! 73

Number 10 on your Feedback card

Common Audio and Speaker Bus

Control noise pollution chaos.

by Hugh Wells W6WTU

If your ham shack is like mine, you have accumulated a number of receivers to monitor all of the frequencies and local activities you're interested in. This can cause a couple of problems, beginning with noise pollution. Also, after becoming addicted to listening to these frequencies, you want to be able to monitor them when you're in a different part of the house. I've solved both problems by installing a common audio bus around the shack and remote speakers throughout the house.

With each receiver blaring away, it was next to impossible to hold a conversation with someone, either in person or on the air, without turning down the volume control on each receiver. I wanted to have a common volume control for all of them, and an audio bus system as shown in Figure 1 was the solution to this problem.

Later, I wanted to monitor the receivers, using remote speakers at several locations in the house. Each remote speaker needed an independent volume control that wouldn't affect the bus volume. Figure 2 shows my solution for this. Although I've used both circuits in my audio bus system, the two could be combined into one system by using the circuit shown in Figure 2. One speaker and its volume control could be placed in the shack, and the remote speakers placed at convenient locations in the house.

In my application, the solution to the common bus system required two independent bus impedance values. Also, one receiver and the remote amplifier had to be powered up and down by remote control along with the receiver's audio being distributed by the bus.

Common Audio Bus

The common audio bus (Figure 1) from all of the receivers had to be high impedance in order to isolate, to a degree, each receiver's output from the bus. Without isolation, bus audio would be driven back into each receiver's output circuit. Assuming a common audio bus of any relatively high impedance, each receiver would inject a small audio signal voltage into the bus. Current/power into the bus was of little concern, and I preferred to keep it at a low value. Because the output from each receiver was taken from the 8 ohm headphone/speaker jack, a nearly correct load impedance was needed for each receiver to maintain performance. I found that a 10-ohm, 1/2-watt carbon resistor worked well as a load since it was not necessary to develop very much audio power in order to drive the bus.

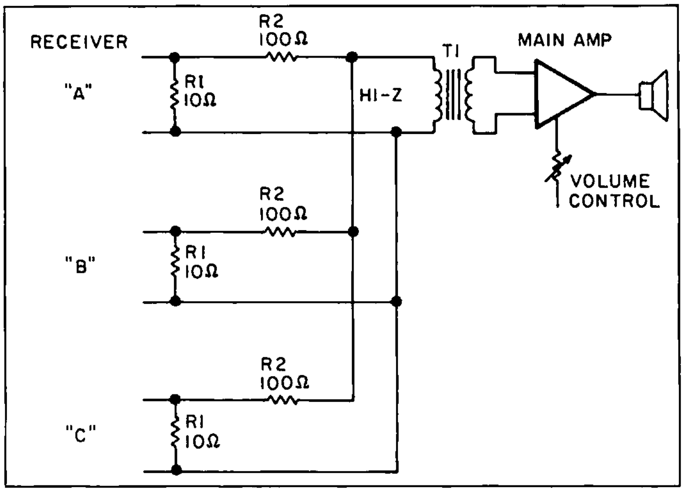


Figure 1. High impedance audio bus for connecting many receivers to a single amplifier.

I used a high input impedance amplifier to receive the bus audio voltage and provide speaker audio for the shack. The amplifier was capable of producing about four watts of audio power, which was more than adequate. I've not specified here any particular amplifier circuit for use with the bus as almost any tubed or solid-state amplifier would work in the system. However, I have a preference for the LM383 IC, which is capable of providing up to 8 watts of audio.

Some attention was required in matching the bus-to-amplifier impedance. I found it desirable to use a coupling transformer between the amplifier and the bus to provide DC isolation, as a hum problem developed through a ground loop between one receiver and the amplifier. The hum problem was easily solved by installing a 600/600-ohm line transformer at the input of the amplifier. It could just as easily have

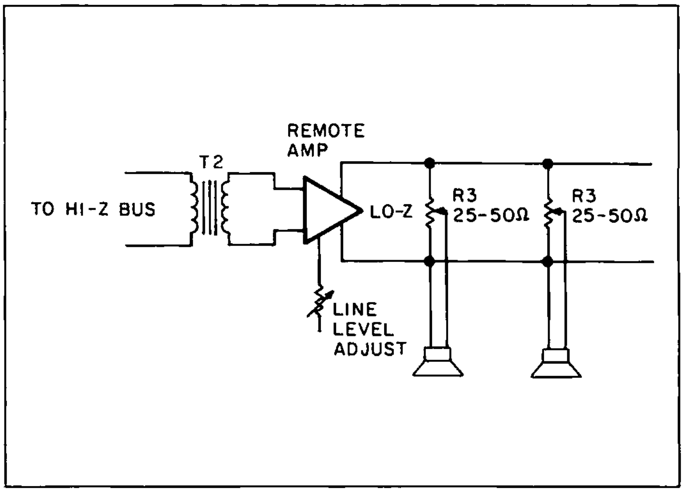


Figure 2. Low impedance audio bus for driving passive remote speakers.

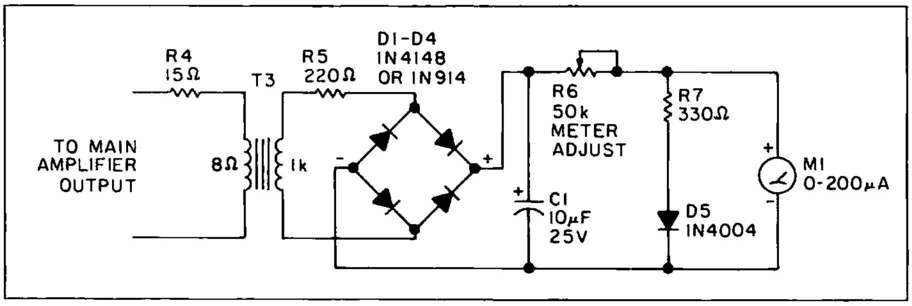


Figure 3. VU-style meter for setting audio levels on a common bus.

been installed at the output of the receiver. Further, the bus system is unshielded, unbalanced and works well as long as noise doesn't develop through ground loops, etc. The bus was made using #24 (paired) speaker wire strung along the shelves in the shack with terminal blocks attached periodically to accept receiver output.

I also tried an 8/500-ohm transistor radio output transformer for matching the bus to the amplifier input. It worked well, but the voltage step-up ratio required more amplifier input attenuation than I wanted for my application.

As an aside, I did notice some frequency response changes, though, while experimenting with different transformer input impedance values. Specifically, when using a 4/10k-ohm impedance ratio followed by a resistor attenuator to reduce the signal voltage, I observed a loss of low frequencies. It was necessary to bypass the attenuator with a capacitor to regain some low frequency response. Of course, the attenuation ratio changed, too. The use of a 1:1 ratio transformer solved the response and signal voltage problems.

Once the audio bus was operating to my satisfaction, I soon wanted to extend the system into the house for remote monitoring. Rather than modifying the first system, I developed a low impedance bus for remote speakers, as indicated in Figure 2. I wanted a single amplifier to drive all of the remote speakers rather than having an amplifier installed at each speaker, which would have required an added power bus. Again, a 4-watt amplifier was transformer-coupled to the high impedance audio bus and the output of the amplifier wired to the remote speakers. Each remote speaker consisted of a 2-inch/16-ohm transistor radio speaker mounted into a box, along with a 20-50-ohm pot used as a volume control. The actual pot resistance value was not found to be critical and values from 15 to 150 ohms worked well. Note that the pot wiper was connected to the speaker, not the bus. The object was to vary the audio power in the speaker without affecting the audio level on the bus. Rarely was it necessary to use more than about 250 mW at a remote speaker, therefore the pot usually stayed below the midpoint.

Frequency response and intermodulation distortion on the audio bus was not a problem. It seems that most amplifiers have a fairly linear sine wave response in the audio spectrum, preventing noticeable mixing products from being created when several audio signals are simultaneously present.

VU Meter

When setting the audio level at each receiver, I found it convenient to have a meter (VU-style) connected to the bus to observe the average signal level from each receiver. (See Figure 3.) I connected the meter circuit to the output of the "main" amplifier, adjusted the output of one receiver to a comfortable level and adjusted pot R6 to provide a mid-scale pointer swing. The output level of each receiver was adjusted to provide the same amount of pointer swing. Because the meter worked so well, it remains connected to my system to provide a continuous VU-style indication for received signals.

The VU-style meter obtains its power directly from the audio output of the "main" amplifier. To obtain sufficient voltage to swing the meter, I used a step-up transformer and rectified the output to provide DC. Because of pointer ballistics, a 10 µF capacitor was used to provide a long time constant to dampen the otherwise rapid pointer movement. I attached a series-connected diode and resistor across the meter to create a square-law non-linear pointer movement. The purpose was to reduce the pointer velocity as it approached the upper mechanical pointer stop, but yet provide an adequate swing below mid-scale. In theory, as the voltage across the meter rises to 0.7 volts, the 330-ohm resistor is shunted across the meter coil, reducing the meter sensitivity and slowing upward pointer movement. Almost any meter having a sensitivity from 50 µA to 200 µA works well in the circuit. A 0-1 mA could also be used, but cir-cuit values would have to be adjusted to accommodate the higher meter current value.

Since installing the common audio bus in my shack, I've been able to free up several independent speaker enclosures for use elsewhere in addition to combining the audio output of several receivers into a common speaker. I've also met my objective of having a single volume control for all of the sounds emanating from the receivers. If your shack needs some audio organization, consider trying a common audio bus system. 73

Parts List

C1	10 uF 25V electrolytic cap	Radio Shack	272-1013,1025
D1,4	1N4148 or 1N914 diode	Radio Shack	276-1122
D5	1N4001-1N4004 diode	Radio Shack	276-1101, 1102, 1103
R1	10 ohm 1/2 watt		
R2	100 ohm 1/2 watt		
R3	25-50 ohm pot	Radio Shack	271-265
		All Electronics	#POTS-50
R4	15 ohm 1/2 watt		
R5	220 ohm 1/2 watt		
R6	50k ohm pot	Radio Shack	271-1716
		All Electronics	LTP-50K
R7	330 ohm 1/2 watt		
T1, 2	1:1 turns ratio transformer	Radio Shack	273-1374
		All Electronics	600/600 ohm #TCTXS
			600/600 ohm #TCTX-1
			300/300 ohm #CPTX-2
T3	8/1k ohm audio output trans	Radio Shack	273-1380
M1	Any 50-200 µA panel meter		

Reference: All Electronics Corp., P.O. Box 567, Van Nuys CA 91408.
(Minimum order is $10.) Phone: (800) 826-5432.

73 Review

by Gordon West WB6NOA

Number 11 on your Feedback card

The MAX System 5-Element Quad

Cellular Security Group
4 Gerring Road
Gloucester MA 01930
Telephone: (508) 281-8892;
(800) 487-7539
Price: $59.95, plus $4 S & H

Easy to assemble and very portable.

Some unique and interesting antennas are available from the Cellular Security Group. Now, I realize that this name may seem a little strange for a company that builds antennas, but their PVC-based antennas are distinctly unique. I have their little telescopic PVC ground plane, and it works super for class demonstrations and portable work. With all the little ground plane elements pushed in you can get up as high as 450 MHz. Fully extended, you are down around 130 MHz. I can't think of anyone else with a collapsible VHF/UHF ground plane!

Quad antennas for 2 meters VHF have the distinct advantage of *portability* and quick assembly. The 5-element quad from this manufacturer uses sturdy white PVC tubing pre-drilled for the boom and the Fiberglas spreaders, and an extra PVC tube for a push-on attachment to support the boom.

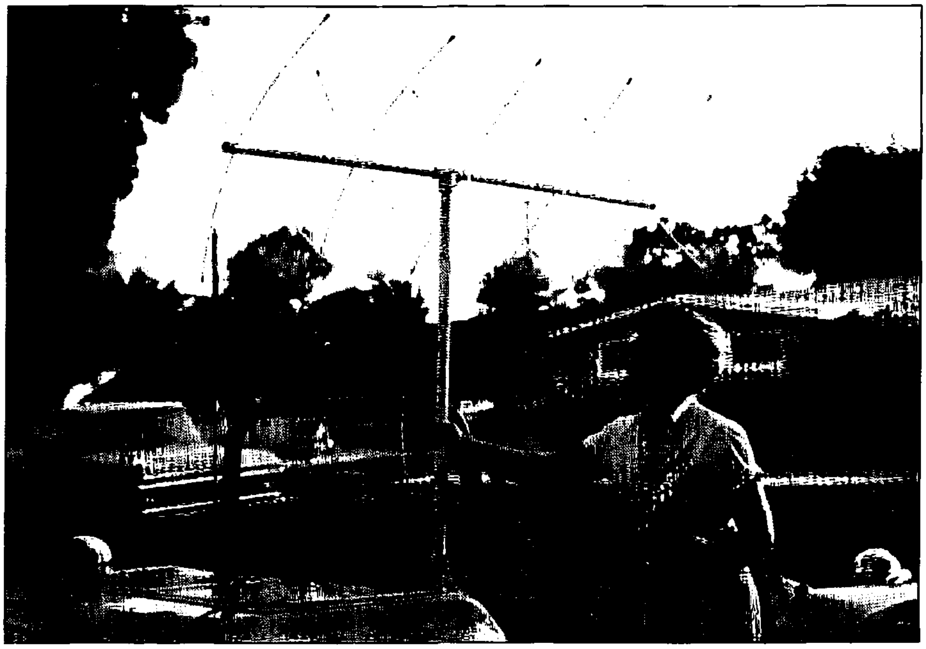


Photo A. The Cellular Security Group's 5-element quad comes complete with a PVC mast.

Assembly

The 2 meter quad is great for newcomers because everything is pre-assembled. The stranded copper wire elements are clearly marked for the three directors: one driven, and one reflector placement. The wire has soldered-on spreader caps that simply pop on to each spreader assembly. The wire element is one total wavelength long, with each side a quarter wavelength. Directors are about five percent smaller than the driven element, and the reflector is approximately five percent larger.

The quad takes about five minutes to assemble. The spreader simply pushes into the holes on the boom. Red-tip spreaders are for the reflector, blue for the director, and black for the driven elements. Cellular Security Group's new improved version of their original 5-element quad also features cotter pins for the exact placement of each Fiberglas rod. The rods behave just like Fiberglas should, and are quite flexible.

As you attach the copper caps with the wire element pre-soldered on, there is gentle pressure that bows the elements either forward or backward. It makes no difference which way you bow the elements—just make sure that each set of spreaders is bowed in the same direction.

The driven element features a matching network which is mounted on the horizontal wire element for long-range, 2 meter, SSB horizontal polarization, or on the vertical side for 2 meter repeater communications. And for fox hunting, you can quickly add in attenuation when you get close to the hidden transmitter by simply going from one polarization to the other by swinging the quad on its side.

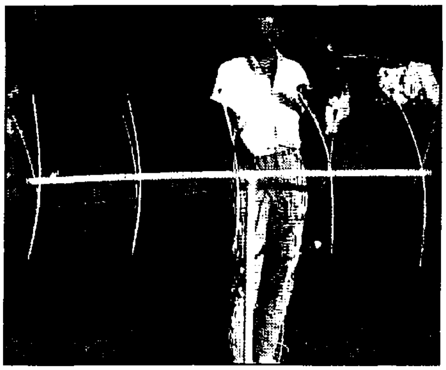


Photo B. The sturdy PVC design keeps the boom from sagging. Be sure to bow all of the spreaders in the same direction.

Performance

Once the quad was assembled we looked at its resonant bandwidth on the handy MFJ SWR analyzer. We backed up our findings with a Bird Model 43 wattmeter. With the antenna held safely above our heads, the SWR was a perfect 1:1.1 at 145 MHz, and at band edges 1:1.4 to 1. This makes it plenty broadband for use just outside the 2 meter ham band by Coast Guard auxiliarists, Civil Air Patrol operators, and MARS operation.

When we elevated the antenna to rooftop level of a single story house, the SWR minimum shifted down slightly 1 MHz. We were still well below 1:1.4 to 1 at the top of the band.

Since this lightweight portable quad makes a handy transmitter-hunting antenna, we were curious to examine what effect hand-holding the boom might have on the directivity of incoming signals, as well as on the overall performance of the antenna. As

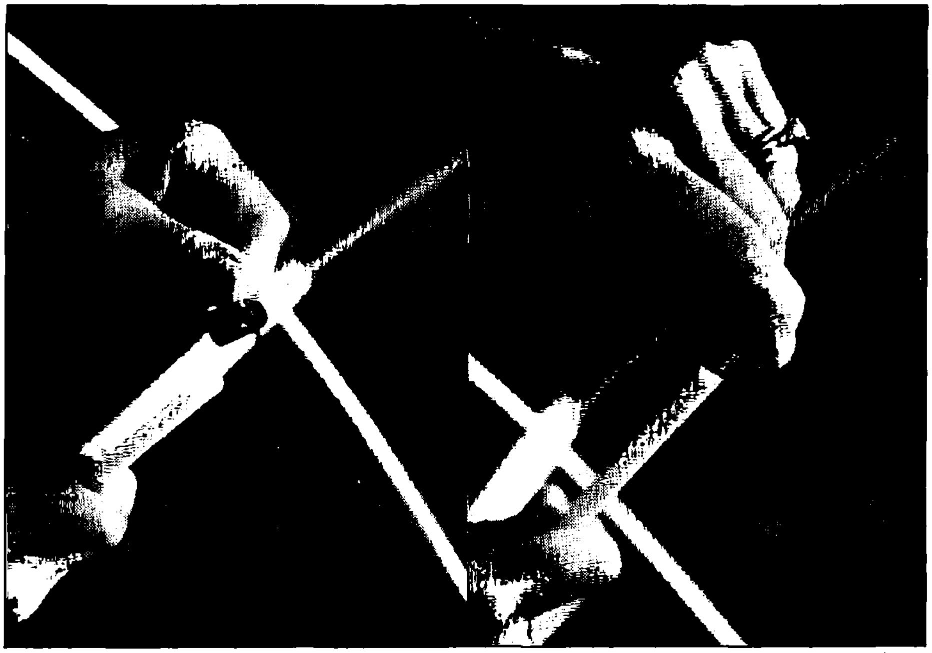


Photo C. The copper end caps at the corners of each quad loop slide over the ends of the spreader arms allowing you to quickly and accurately assemble the quad.

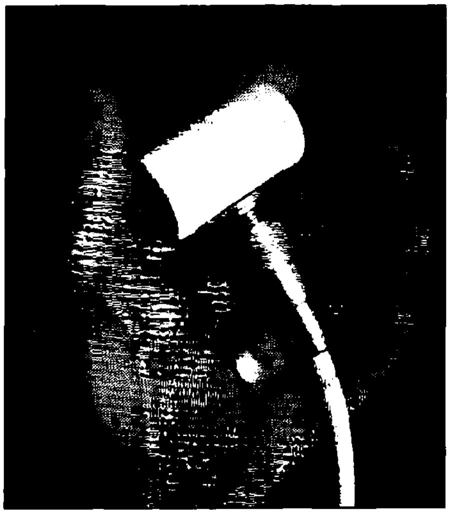


Photo D. Close-up of the feedpoint assembly.

long as you keep your fingers off of the antenna wires you can't tell the difference. However, we would never suggest holding the antenna by the boom when transmitting—even with flea-powered hand-held transceivers. Rather, use the supplied vertical PVC mast, and you will be assured of low SWR and a good clean forward lobe. It is advertised as an 11 dB forward gain antenna, probably 11 dBi. This is a pretty healthy figure for a boom length of only 5 feet, so I would simply go on record in saying that the quad is very directional, with very noticeable signal attenuation off the sides and off the back. Its front-to-back ratio is listed as 25 dB, but again, the testing we were doing was only with observed incoming and outgoing signal strengths.

Because the unit is so lightweight, it's ideal to take along on a VHF 2 meter mountaintop expedition. You can pack the spreaders and the wire elements inside the PVC tubes for safekeeping. Some little end caps keep everything in place, and a couple of extra pounds in your backpack is next to nothing on a local hiking trip. You supply your own coaxial cable harness, and we recommend RG8X so as not to distort the wire element attached to the matching network. If you're going to leave this unit out in the open air for some time you would want to seal up the PL259 connection with Coax Seal™ available from Universal Radio, Reynoldsburg, Ohio.

I did work some fantastic DX on this little antenna during the June VHF/UHF contest. An SSB station 400 miles away down in Mexico was able to hear our tropo signals just about as well as nearby operators running long boom yagis with plenty more gain. This proves the point that once a 2 meter path is open, a good directional antenna may really pick up signal strengths at both ends of the circuit.

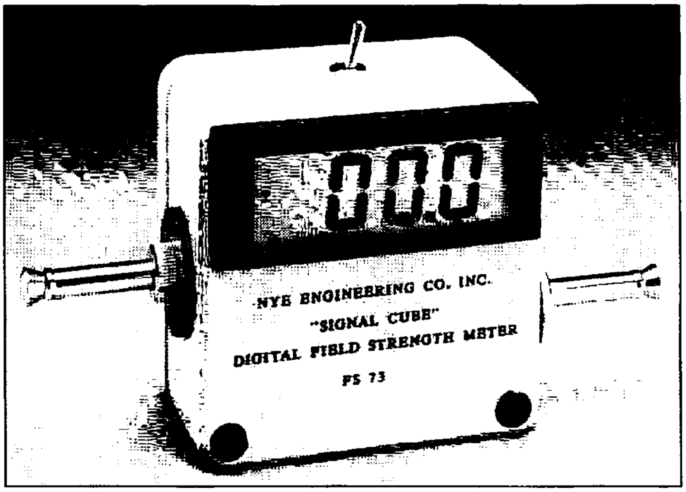
The MAX System Quad will give you a terrific-performing setup for under $60. Best of all, everything is color-coded. So, even if you immediately lose the instructions, it would be tough to put this thing together wrong. And since the spreaders are made of Fiberglas-like materials, there's not that age-old problem of pulling down on the wire elements and having a wood dowel suddenly snapping in half. The element end caps are also smoothed out for safety protection, so with a little care this antenna should be safe around everyone on a mountaintop expedition. For added safety at moderate power use you could even coat the bare-stranded wires with a non-conductive, flexible compound available at most hardware stores.

And while assembling this little antenna in less than two minutes isn't much of a chore, it is sort of a kick to let the kids put it together, and to communicate from an antenna akin to a home-brew array. ■

NEW PRODUCTS

Number 12 on your Feedback card

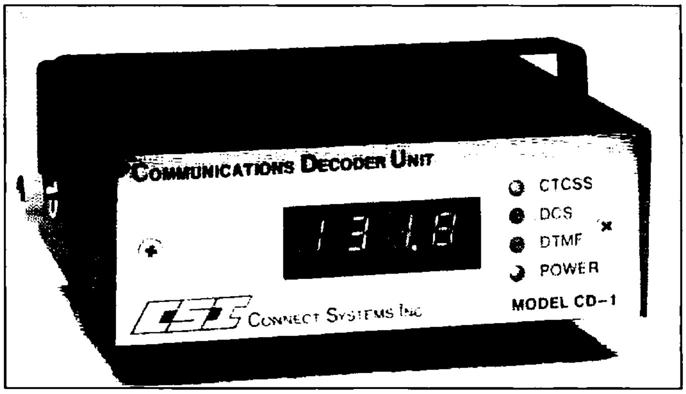
Compiled by Hope Currier



NYE ENGINEERING

Nye Engineering has announced a new and unique digital field strength meter for amateur and commercial use. The FS73 "Signal Cube" is a heavy duty model, 2.5" square and 2" deep, with a splash-proof cast aluminum case and has a large 3-1/2 digit LCD display indicating RF amplitude. It is broadband (0.1 to 450 MHz) and can be used for absolute or relative readings. A calibration chart on the back of the unit can be used to determine actual volts per meter, up to 150 MHz. The unit uses a standard 9V transistor battery and will operate for two months if the battery switch is left on (a low battery message shows on the display).

The FS73 Signal Cube has many uses, including checking radiation patterns of antennas at relatively great distances, and checking RF levels and detecting sources. It is priced at $159. For more information, contact *Nye Engineering Co., Inc., 4020 Galt Ocean Dr. #606, Fort Lauderdale FL 33308; (305) 566-8560, Fax: (305) 537-4711.* Or circle Reader Service No. 201.



CONNECT SYSTEMS

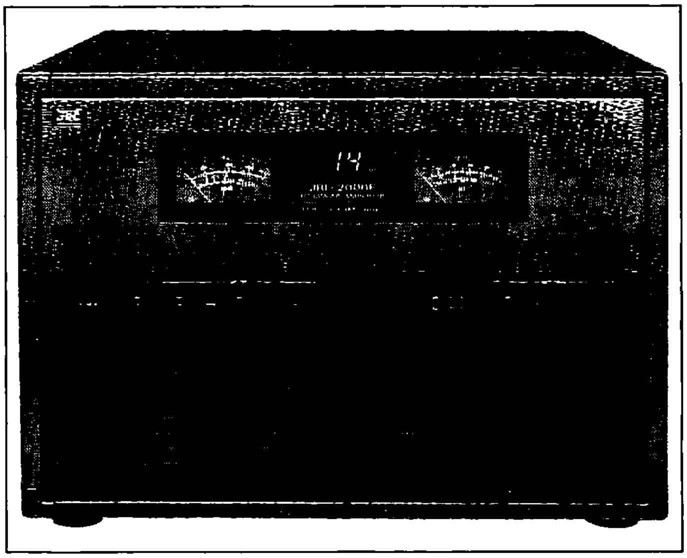
The new Model CD-1 from Connect Systems Inc. decodes and displays 104 DCS codes, 50 CTCSS codes and all 16 DTMF digits. The CD-1 is intended to be used with service monitors to provide important additional capabilities. However, it can also be connected to any receiver or scanner to check radios or to monitor shared repeaters and display the current user's DCS/CTCSS code. The CD-1 also displays DTMF codes such as ANI, access codes, phone numbers, etc. DTMF sequences are automatically replayed just in case you missed it in real time or the sequence was too fast to observe.

For prices and more information, contact *Connect Systems Inc., 2064 Eastman Ave., Suite 113, Ventura CA 93003; (805) 642-7184, Fax: (805) 642-7271.* Or circle Reader Service No. 205.

RABUN LABS

Rabun Labs, Inc. has announced a new product line that is a revolutionary new concept in electrical and electronic equipment protection technology. The Incipient Lightening Detection and Protection System (ILD/P Series) detects the presence of lightning when a storm is typically 5 to 10 miles away and protects equipment by automatically disconnecting power sources, telephone lines and coax cables. The system automatically restores all power and other connections after the storm is out of the area. Various models are available for amateur radio and two-way communications equipment, satellite receiving systems, computer and data processing equipment, well pump motors and air conditioning compressors.

For prices and more information, contact *Rabun Labs, Inc., P.O. Box 790, Clayton GA 30525; (800) 788-1824.* Or circle Reader Service No. 202.



JAPAN RADIO

Japan Radio Company, Ltd. has announced their newest product, the JRL-2000F HF linear amplifier, the world's first MOSFET linear amplifier for the ham radio market. JRC has developed several MOSFET transmitters for commercial HF applications up to 10 kW, all using the same single-ended push-pull circuit design found in the JRL-2000F. The JRL-2000F's 48-MOSFET power amplifier offers lower IMD and harmonic distortion than convention bipolar-type transistor amplifiers, a higher output power margin, higher efficiency, greater final device durability, and better linearity across wide frequency ranges. It features a built-in automatic antenna tuner and four antenna output connectors. Any exciter can be used; the unit senses the input RF and automatically tunes the amp to the operating frequency. The internal CPU stores band, tuner and antenna settings to one of 1,820 memory channels for fast recall. A built-in switching power supply utilizes a unique power factor correction (CFC) circuit to improve efficiency and reduce power consumption.

The suggested retail price for this amplifier is $4,899. For more information, contact *Japan Radio Co., Ltd., 430 Park Avenue, New York NY 10022; (212) 355-1180, Fax: (212) 319-5227.* Or circle Reader Service No. 204.

ANTENNAS WEST

The Pico-J from Antennas West is a sleek, tough end-fed half-wave antenna ready to hang anywhere. It can be attached to window glass or curtain rods, or suspended in an apartment closet, in a patio doorway, in a motel window, or from a light fixture. When not in use it rolls up and fits into a 4 oz. pocket-sized holder.

The Pico-J doesn't need radials for broadband low-angle omidirectional half-wave gain. It improves received signals, stretches simplex range, reaches far-away repeaters, and saves your pack. Priced at $19.95 ppd., it comes ready for work with 72" isolated coaxial feedline and a gold pin BNC. For more information, contact *Antennas West, 1500 N. 150 W., Provo UT 84604; (801) 375-4664, (800) 926-7373, Fax: (801) 373-8425.* Or circle Reader Service No. 203.

NEW PRODUCTS

CONTACT EAST

The 68-piece Workstation Specialist Kit from Contact East is designed for specialists servicing PCs, file servers, workstations and I/O devices. It contains commonly needed tools plus special tamper-proof fastener tools needed to access computers and monitors. Included are testers for duplex power outlets and telephone jacks and extractors. Three case styles are available: Model 68-TCD2 with a single compartment, brown Cordura case; Model 68-CDS2 with two compartments (one for documents), in a khaki Cordura Plus case with leather-like trim and a detachable shoulder strap; and Model 68-CDS3, 100% ESD-safe, with static-conductive foam, grounded through a common point grounding snap, made of specially treated static-dissipative gray Cordura Plus fabric, with a 5-foot ground cord and 5-foot coiled cord and adjustable wrist strap. All cases have three outside pockets.

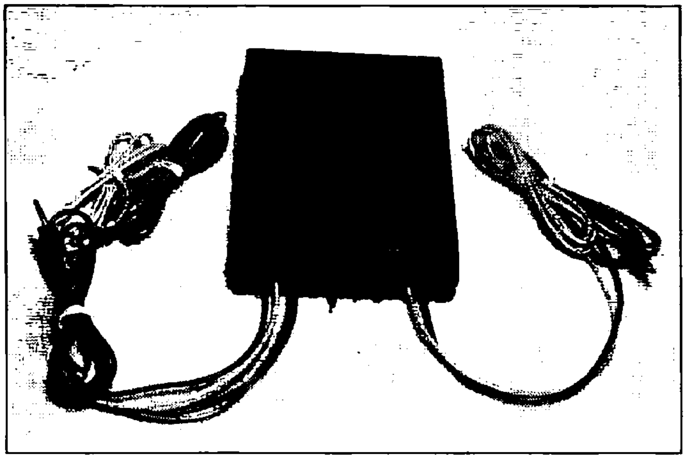
Prices range from $235 to $323. For more information, contact *Contact East, 335 Willow Street, N. Andover MA 01845; (508) 682-2000*. Or circle Reader Service No. 206.

ELECTRON PROCESSING

Electron Processing has introduced a simple means to put a linked repeater or bi-directional link on the air quickly and without excessive expense. Ease of use and low cost make the BRI-2-DUAL and BRI-2-RB ideal for HT range extension, mobile/portable repeaters or dual frequency linking operation. The BRI-2-DUAL provides a bi-directional link configuration when connected to two transceivers. In this configuration, all signals received by one radio are transmitted on the other and vice versa. The BRI-2-RB is configured to provide a standard duplex repeater operation with connection to another transceiver in "remote base" type operation. The repeater is then linked to whatever repeater or frequency the second transceiver is tuned to.

No internal modification of your equipment is needed as it connects to the external speaker output of your receivers and the mike jack of your transmitters. All the basic necessities of repeater or relay operation are provided. Audio Isolation and PTT transmitter keying using a VOX circuit makes connection to your equipment simple—just wire your microphone plug! A five-second "hang" time and a three-minute "timeout" timer are both provided (and can be disabled). Both units are powered by 12 VDC.

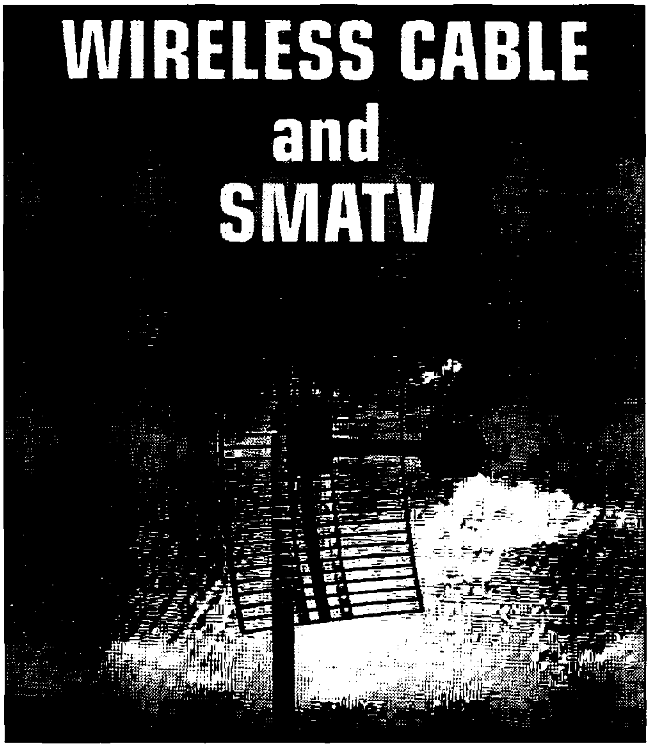
The BRI-2-DUAL and the BRI-2-RB each sell for $85, plus a $5 shipping/handling charge. For more information, contact *Electron Processing, Inc., P.O. Box 68, Cedar MI 49621; (616) 228-7020.*



BAYLIN PUBLICATIONS

Baylin Publications has announced a new book, *Wireless Cable and SMATV*. This 400-page, 8-1/2" x 11" publication expands upon an earlier work, *Satellite, Off-Air and SMATV* and includes a completely new 170-page section on wireless cable/MMDS systems, as well as a chapter on private cable security systems. It has over 200 photos and illustrations that support the goal of allowing even a non-technical person to develop a comprehensive understanding of wireless cable and SMATV.

Wireless Cable and SMATV is priced at $50, plus $4 shipping and handling. Contact Baylin Publications, 1905 Mariposa, Boulder CO 80302. *Or circle Reader Service No. 207.*



ATV Transmitter, Part II

Get on ATV easily and quickly.

by Rudolf F. Graf KA2CWL and William Sheets K2MQJ

[Last month we looked at the theory of operation and the circuitry involved to build a compact 1-watt ATV transmitter for the 70cm band that operates with a 9-volt supply. In this final segment, we'll show you how to complete the assembly and test the circuit. Keep in mind that you will need the appropriate amateur license to operate ATV on 70cm (Technician or higher) and you must stay within the amateur band frequency limits.—Ed.]

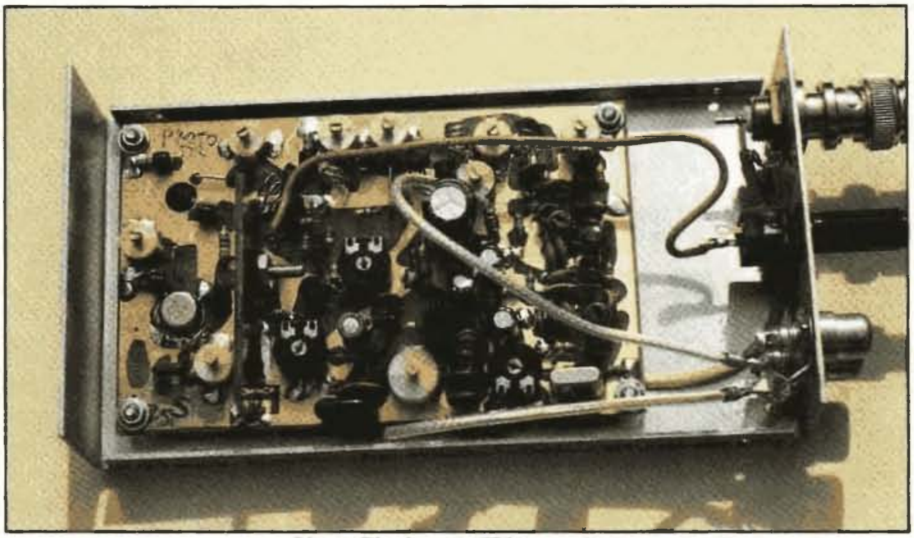


Photo. The 1-watt ATV transmitter.

Remember that this transmitter is basically an AM transmitter with very wide modulator frequency response. Construction of the transmitter board should pose no special problems as long as you take care to duplicate the prototype as closely as possible.

Assembly Hints

Some precautions to take are:

1. Use only G10 0.062" thick epoxy Fiberglas board material. Other materials and thicknesses could be used, but may result in different tuning conditions and stray capacitances. However, do not use paper-base phenolic material—it is too lossy at the high frequencies present in this transmitter.

2. Q12 must be heat-sinked. A possible 3-watt dissipation makes some form of heat-sinking mandatory. The method shown in Figure 7 has proved adequate if at least one-ounce copper is used. If possible, use 0.040 copper or brass, but this is not absolutely necessary. Q7 is adequately heat-sinked, if the metal case is soldered to the PC board ground plane, for a normal transmit-receive duty cycle (one minute on, one minute off). For continuous operation use a clip-on heat sink that encircles the can of Q7 (use the type that has spring fingers) and, if possible, add a few fins to this, or bolt this clip-on heat sink to a larger piece of aluminum or copper (preferred), or even the mounting case, if possible.

3. Solder as many component leads as possible, on top of the board, that pass through the ground plane to both the top and the bottom of the board. In particular, the ground lugs on all trimmer capacitors should be soldered on both sides. The same is true for most of the resistors that have one side connected to ground. The idea is to ground as much of the ground plane (shield top side) to the ground foil on the component side, in as many places as possible. This is especially important around Q4 through Q7.

4. Use chip capacitors where specified. Do not substitute ordinary leaded capacitors. Use only those components specified, no substitutions.

5. *Keep all components as close to the PC board as possible, and the leads as short as possible.*

6. Take care to make coils as accurately as possible. While some error can be tolerated, accurate work will make tune-up easier and assure duplication of results. Expect that some coils (L1, L2, L3, L14) may require addition or subtraction of a turn.

Construction is started by first installing all resistors and then D1 and D3. (Do not forget ferrite beads on R15, R17, R19, and R21.) Next, install all disc ceramics 0.01 µF and 470 pF. The NPO capacitors are installed next. After the NPO capacitors are installed, install potentiometers R22, R32, and R33. Solder the grounded sides of R22 and R33 to both sides of the PC board.

Next, install all the trimmer capacitors. Note that C18 and C40 are different from the rest. Solder ground tabs of all the trimmers to both the top and the bottom of the PC board. Next, install Q1 through Q5 and Q8 through Q11. Do not install Q6, Q7 or Q12 yet. Now, wind and install L1 through L9, and L14. Last, install chip capacitors C22, C24, C44, and C20 and make sure to omit C22.

Check all of the PC board for shorts, solder bridges, and trim away any excess foil with a sharp knife (X-acto™ type or equal). Make sure any excess foil on the top side isn't touching any component leads not intended to be grounded. Slight misregistration of the top foil may cause this. Simply trim excess foil away with an X-acto knife. Note that Q6 and Q7 and associated circuitry is best installed after the remainder of the board is completed and tested. Now install Q12 and heat-sink per Figure 7 and also Figure 3. Note that the heat sink also serves as an RF shield for the Q6 and Q7 power amplifier. Be sure to solder the heat sink to the top foil side (ground plane), on each side of the heat sink where it butts against the PC board. Note that Q12's case should be insulated from the heat sink. Use a TO-220 insulator (cut to size) or a scrap of mica, mylar, polyethylene, or teflon tape (used in plumbing work). You are now ready to test the main part of the board. Q6, Q7 and associated components will be installed after testing the rest of the PC board.

After checking for shorts and opens and solder bridges, measure the DC resistance between B+ and ground. It should measure greater than 100 ohms. If it's lower, check for the cause before proceeding further.

Next, install the slugs in L1, L2, and L3 if you have not already done so. The slugs should be initially set fully inside the coils. Set R22, R32 and R33 about halfway between extremes of rotation. Set C40 halfway meshed (see Figure 3). Set all other trimmers to half mesh. Final settings will depend on operating frequency, coil construction technique, and application. (Refer to Figure 3 for location.)

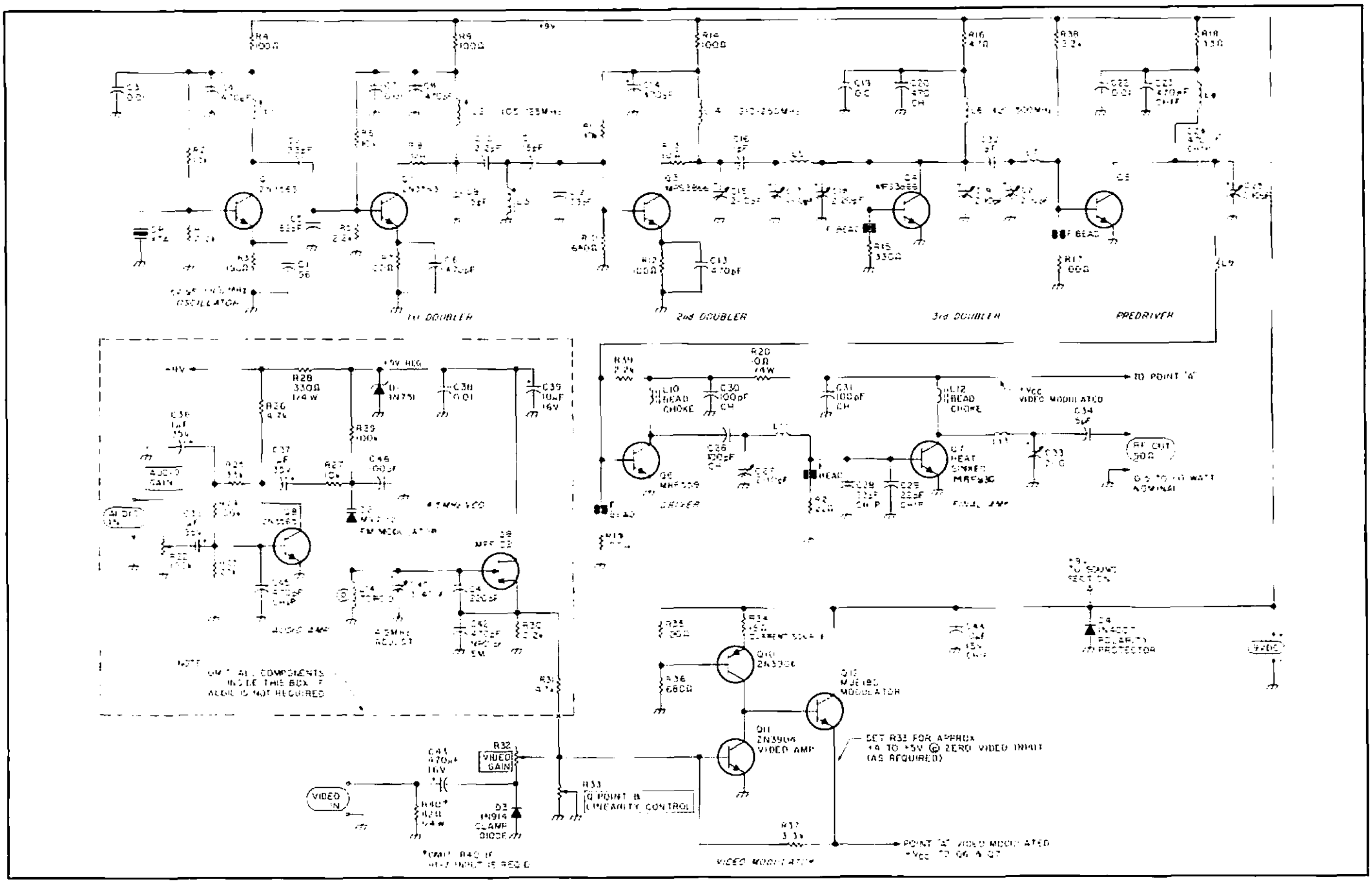


Figure 1. Schematic diagram of the ATV transmitter.

Final Test

Next, apply +9 volts to the B+ line after connecting the negative supply lead to the ground plane of the PC board. Immediately observe the power supply current. If it's over about 150 mA there may be a problem. If anything smokes or gets hot, immediately remove the power and find the problem before proceeding.

If all seems OK, connect a VOM (analog meters are easier to use for this test, but a DVM is OK) across R3 and then R7. You should read about 2 volts DC (1.5 to 3VDC is OK). Next, connect the VOM to Q3's emitter. You will probably read 1 volt or less. Now, connect the VOM to point A (Q12's emitter) and ground. Verify that adjusting R33 through its full range can vary the voltage at point A between less than 3 volts to greater than 8 volts. Set R3 for full voltage (>8V) at point A for now. Next, measure the voltage at Q8's collector. About 3 volts is OK. Next, measure voltage across D1 (1N757A). It should be between 5 and 5.2 volts DC. Significantly more or less indicates a problem in Q8, Q9, or associated circuitry. Check for 5 to 5.5 volts across D2. If it reads less than 1 volt, D2 is either installed backwards or is shorted. Make sure C37 has the (+) lead connected to R27.

If it is OK, install crystal CR1. Connect the VOM across R7. Apply +9 volts. Now slowly back the slug of L1 out of the winding. You will find that the voltage across R7 will suddenly increase, then slowly decrease as the slug in L1 is tuned. Adjust the slug for maximum voltage (2 to 4 volts is typical) and then back out the slug for about a 10% drop. This will ensure stable oscillation. As a check, a frequency counter connected to the junction of C2 and C5 should indicate the crystal frequency. An unstable reading indicates possible problems in that the crystal is not controlling the frequency. If this is the

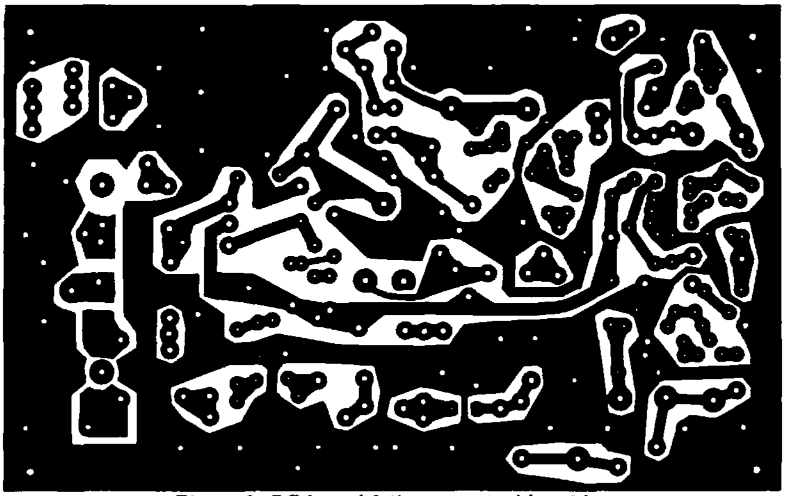


Figure 2. PC board foil pattern (solder side).

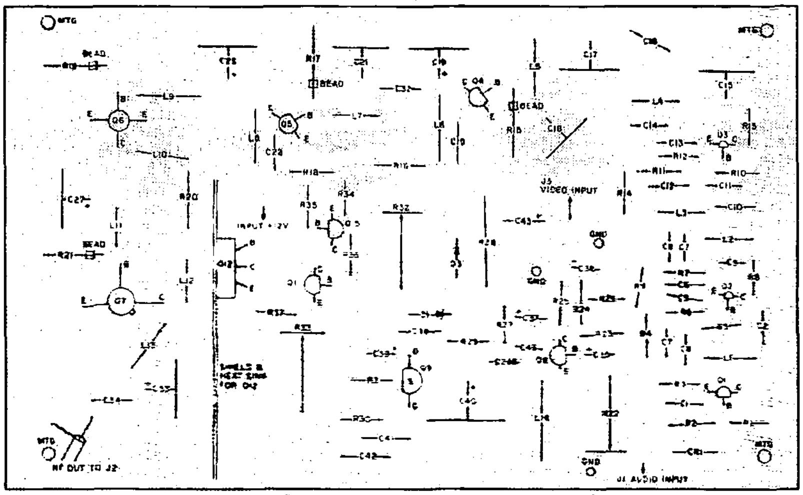


Figure 3. Parts placement (component side).

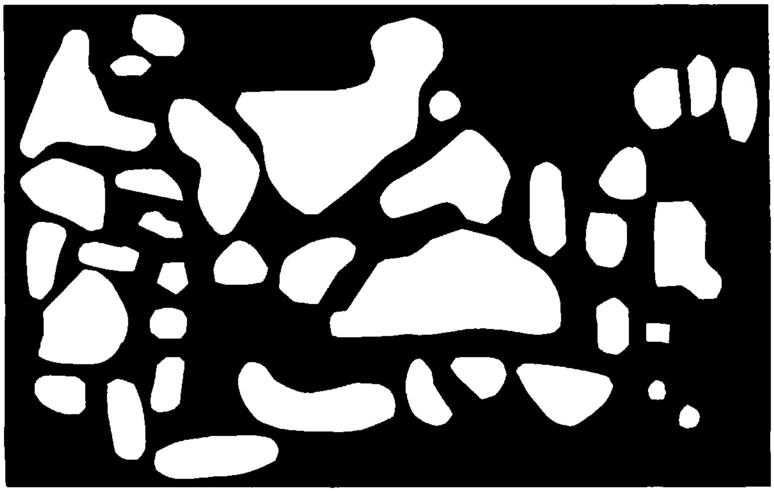


Figure 4. PC board foil pattern (component side shield layer). Solder leads on both side of the PC board where necessary.

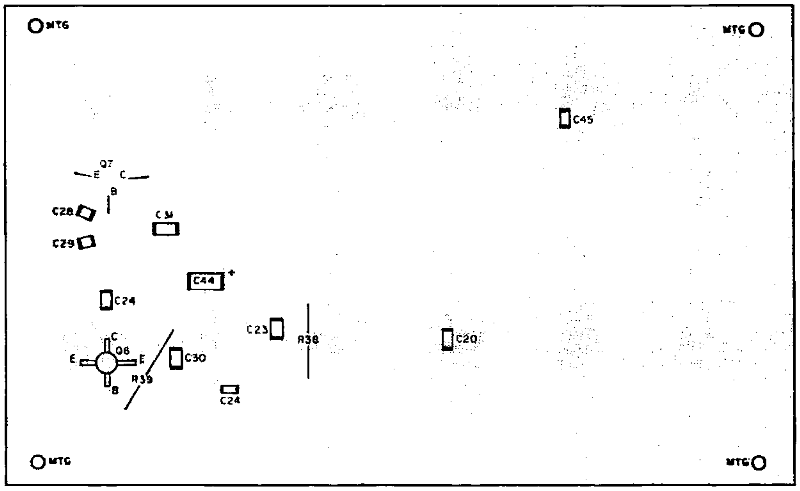


Figure 5. Parts placement of the components that need to be mounted on the solder side of the PC board (the opposite of the component side).

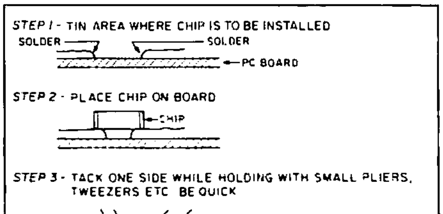


Figure 6. Surface mount assembly hints.

case, try readjusting L1. If you have installed more than one crystal and a switch, adjust for the higher frequency crystal. Next, connect the VOM across R12. Adjust L2 and L3 for maximum voltage. This will be 1 to 2 volts. If the slugs in either L2 or L3 have no definite peak, add or subtract a turn from that coil as required, after first checking C9, C10, C11 and C12 for the correct value. Adjust for all crystals if applicable. A compromise may be needed. In this and any following, tuning adjustments of crystal frequencies are such that >5 MHz of output frequency spacing is required.

If less than 1.5V is obtained, check dimensions L2 and L3 (often L2 wants to be one turn less than L3). Usually, L2=3-1/2T and L3=4-1/2T.

If you cannot get these results, go back and find the problem. *DO NOT PROCEED FURTHER.*

If everything is OK, connect the VOM across the junction of R16 and C20. (+LEAD) and GND (-). Tune C15, C17, and C18 for *minimum* voltage (this will initially be around 9V and should drop below 6 volts or so). If this is OK, next connect the VOM across the R18 positive lead to a 9V supply, the negative lead to JCT C23 and R18, then tune C19 and C21 for maximum voltage drop across R18 (typically ≥ 2V DC). Readjust C15, C17, and C18 until no further drop is seen across R18. Check with all crystals, if applicable. If the drop is small, try readjusting C18. It may help to go back and repeak all stages Q3 and Q4 for best results.

Next, if all the previous tests are successful, you can install the components in the power amplifier sections of the transmitter PC board. First, install resistors associated with Q6 and Q7. Install Q6 and Q7 (watch the orientation and refer to Figure 3), install L10, L11, L12, and L13.

Last, install chip capacitors C26, C28, C29, C30, and C31. See Figure 3 for correct chip placement. Do not overheat the chips. Make sure the PC board is tinned in the areas where chips are installed. The best way to install them is to first tack-solder one side of the chip capacitor. Then, solder the other side. Now, resolder the first (tack-soldered) side. See Figure 5. Do not overheat. Use a 25-watt iron with a pointed tip. Small fine-point needle-nose pliers or tweezers should be used to manipulate the chip capacitors. C44 is somewhat large, but C28 and C29 are tiny. Finally, install C34 and a suitable length of small 50-ohm coax cable to J2. Check all joints for solder bridges. Make sure that the metal case of Q7 is soldered to the top ground plane (top side). Q7 has a reverse pinout—the emitter is internally connected to the case. Install Q7 and connect leads to the underside of the PC board using as short lead lengths as possible. Q7 must be flush with the ground plane. Check all connections, and then connect the PC board to a 50-ohm load or, ideally, a 50-ohm wattmeter reading 0-5 watts if you have one good at 450 MHz. Connect the power supply and apply 9V. Adjust R33 for maximum voltage (≥ 8 volts) at point A (Q12's emitter). Now watch the power supply current (now at about 100-150 mA). Adjust C25 for maximum current draw, then adjust C27 for further current increase—this will go to 300-600 mA.

Now, adjust C25, C27, and C33 for maximum RF output from Q7 at J2. You should be able to get about 1 watt of RF out. Adjust R33 to bring RF output down to 0.2 to 0.3 watt. Connect a counter between emitter Q12 and ground. Adjust C40 for a 4.500 MHz frequency. (5.500 MHz for PAL use. Skip this step if you omitted audio circuitry.) Do not apply any video or audio. Verify the transmitter output frequency with a counter. Adjust L1 as required. Readjust all tuning adjustments for optimum performance. Check all crystal frequencies for proper operation.

Battery Operation

This transmitter is intended to operate from a nominal 9V source. A maximum of +10V is recommended and a minimum of 7.5 volts. The appropriate "end point" of performance is about 6.5 volts, below which output drops very rapidly. A seven-cell NiCd pack of 8.4V (actually about 9.8V full-charge) will allow efficient utilization. Also, six alkaline batteries (your typical AA cell is good for about 1.5 ampere-hours) makes a good supply. Remember that, in general, batteries tend to lose effective "ampere-hour" ratings at very high or very low

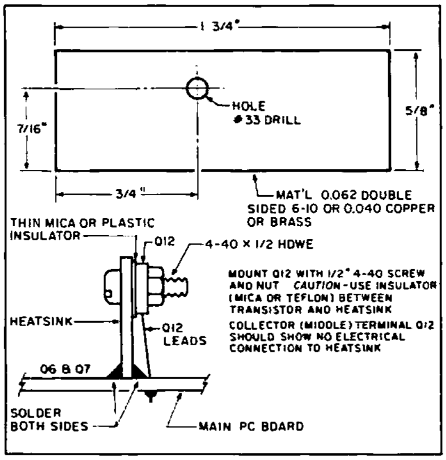


Figure 7. Fashioning a heatsink for transistor Q12.

discharge rates. A 100 mA-hour 9V NiCd of the type used in transistor radio applications will last 10 to 20 minutes. This is OK for R/C model airplanes where a short duration flight is contemplated. A 9V alkaline battery will go about one half hour. AA NiCds (six) will run this transmitter 45 minutes to an hour on a charge. Large "D" size 4Ah NiCds should run the transmitter eight to 12 hours. The choice of battery is a compromise between the size and weight allowable and the expected longevity expected in a particular application.

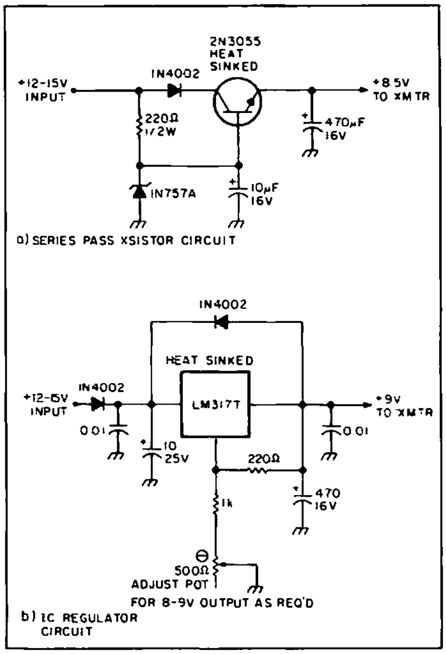


Figure 8 (a). A series pass transistor regulator circuit for use with power supplies between 12 to 15 volts. (b). An alternative IC voltage regulator circuit.

Operating From a +12 VDC Source

Often, a 12V DC source for the main station, such as an auto or boat battery, a power pack, or a 12V supply, is available. The 9V transmitter can be operated from these sources using a regulator circuit. Two approaches are shown. One uses a simple pass transistor and zener diode regulator. The other uses an IC regulator circuit. While the pass transistor and zener should prove adequate, purists will probably prefer the IC regulator. Both circuits require the regulator element (2N3055 or LM317T) to be heat-sinked, since a possible 5-watt dissipation could occur with a +15V maximum input voltage. This would produce a 6V drop with a 0.5A drain. Figure 8 shows two such circuits that would be applicable. Do *not* use 9V "wall transformers;" they have poor regulation and may damage the transmitter or produce video hum at 60 to 120 Hz.

The World of ATV

Whether you use the ATV transmitter for mobile, portable or home station operation, you will find it to be a stable and reliable performer. Hopefully it will provide you with a glimpse into the fascinating world of Amateur Television.

Parts List

Resistors: 1/8 or 1/10W

P/N	Value
R1,R5,R38,R39,R30	2.2k ohm
R2,R6,R11,R27	10k ohm
R3	150 ohm
R4,R7,R9,R12,R14, R17,R19,R35	100 ohm
R8,R13	10 ohm
R10,R36	680 ohm
R15	330 ohm
R16	47 ohm
R18	33 ohm
R20	10ohm 1/4W
R21	22 ohm
R22	100k pot
R23	22k ohm
R24,R29	100k ohm
R26,R31	4.7k ohm
R27	10k ohm
R28	330 ohm 1/4W
R32,R33	1k ohm pot
R34	15 ohm
R37	3.3k ohm
R40	82 ohm 1/4W

Inductors:

L1 - L14 See the Coil Table in Part I of the Article.

Capacitors:

Capacitor	Type
C1	56 pF NPO
C2,C12	33 pF NPO
C3,C7,C19,C22,C38	0.01 disc
C4,C6,C8,C13,C14	470 disc
C5	82 pF
C9,C11	15 pF
C10	2.2 pF
C15,C17,C19,C21, C25,C27,C33	2-10 trimmer
C16,C32	1 pF NPO
C18	2-18 trimmer
C20,C23,C24,C45	470 pF chip
C26,C30,C31	100 pF chip
C28,C29	2.2 pF chip
C34	5 pF mica
C35,C36,C37	1 µF/(35 or 50V) electrolytic
C39	10 µF/16V electrolytic
C40	3-40 trimmer
C41	220 pF NPO
C42	470 pF NPO
C43	470 µF/16V electrolytic
C44	10 µF/15V chip tantalum
C46	100 pF NPO

Semiconductors:

Q1,Q2 2N3563	transistor
Q3,Q4,Q5 MPS3866	transistor
Q6 MRF559	transistor
Q7 MRF630	transistor
Q8 2N3563	transistor
Q9 MPF102	transistor
Q10 2N3906	transistor
Q11 2N3904	transistor
Q12 MJE180	transistor
D1 1N757	diode
D2 MV2112	varactor diode
D3 1N914	diode
D4 1N4007	diode

Miscellaneous

1 toroid 76T188
6 ferrite beads
3 blue slugs (Cambion)
1 PC board
1 T0220 insulator
1 4-40 screw, nut, lockwasher
1 8-32 screw 1" (for winding of coils)
2 ft. #22 enameled wire
2 ft. #22 tinned wire
2 ft. #32 enameled wire
1 crystal 52.5 - 55 MHz

NOTE 1: Kits consisting of the PC board and *all* parts that mount on the board are available from North Country Radio P.O. Box 53H, Wykagyl Station, New Rochelle NY 10804.

The 1-watt ATV transmitter kit + crystal for 439.25 MHz is available for $112 + $3.50 postage/handling. Crystals for 434.0, 426.25 or 421.25* MHz are an additional $7.50 each.

A 12-volt version of the ATV transmitter capable of a 2 watt output (similar in design to the 9-volt version - see the June/July '89 issues of Radio Electronics for details) is available for $110 + $3.50 p/h with ATV crystal.

A metal case (5-1/2" x 3" x 1-1/4") suitable for the 9-volt or 12-volt versions of the transmitter complete with one power, one BNC and two RCA connectors is also available for an additional $15.

To help you assemble a complete ATV station, two other items are also available: an ATV linear amplifier to boost your output power for $79.50 + $3.50 p/h and a low noise (1.5 dB typical) ATV downconverter kit to enable reception of ATV signals using a standard TV set for $59.50 + $3.50 p/h.

A complete catalog of all products is available. Please send an SASE (with 52 cents postage).

*NOTE 2:Operation on 421.25 MHz requires use of a VSB (Vestigial Sideband) filter (not available from North Country Radio but supplied by others) to prevent LSB components from being radiated outside of the band limits.

73 Review

Number 14 on your Feedback card

by Ed Karsin W3BMW

The "Super Guy" Tower Guy

A simple method for tower support.

Foresight Products, Inc.
6430 East 49th Dr.
Commerce City CO 80022
Information: (800) 325-5360
Price Class: $10 each

Many of us have tried to use an earth screw anchor to guy our towers. It's reasonably priced and simple enough to install. I attempted to install one but, after penetrating two feet of soil, I struck shale and became disheartened. I realize that the earth screw anchor has its place. Unfortunately, its place and my property have little in common. I had to find an answer somewhere or my two beams would be spending the stormy weather on the rear patio, rather than up on the 40-foot tower.

An obvious alternative at this point would have been to dig three holes distanced from the tower at the appropriate 120 degree locations, pour in the concrete, and install guy wire holding rods. The concrete could then be covered with the loosened soil and compacted for strength. But the thought of that much digging made me search for an easier method of guying.

With luck and a little research I found the answer, and just possibly your answer to the ground guy wire attach point problem. It's called a Duckbill® anchor. This simple, inexpensive, easy-to-install device is one of the best-kept secrets in hamdom. It really is a "Super Guy" ground level attach point for your tower's guying system. The photographs give a clear indication of its simplicity. Yet, the Duckbill's capabilities and strength approach the unbelievable.

The Duckbill

The Duckbill anchor is manufactured by Foresight Products of Commerce City, Colorado, but many distributors of the product are located throughout the country. One need only glance at the photographs to recognize how the device received its name. The Duckbill is used in numerous ways by nurseries and building contractors as it offers tremendous holding power for its size and small cost.

Feeling quite pleased with my "find," I ordered six Duckbills, along with an installation Duckbill Drive Rod, Model DR-3. Within the week, the Duckbills and drive rod were delivered by the famous "Black Truck."

The model I selected was the 88DB-1 Duckbill Anchor/3000, priced at $9.98 each. Basically, the 3000 indicates the approximate amount of pound pull the device will withstand. Under certain circumstances, one can easily assume that guying the tower at the triangular top will offer a 9,000-pound resistance to the wind forces at that point, given a correct guy wire tension on each guy, and of course, soil consistency. Surprisingly enough, the greater the soil's sand content, the greater the holding power of the Duckbill.

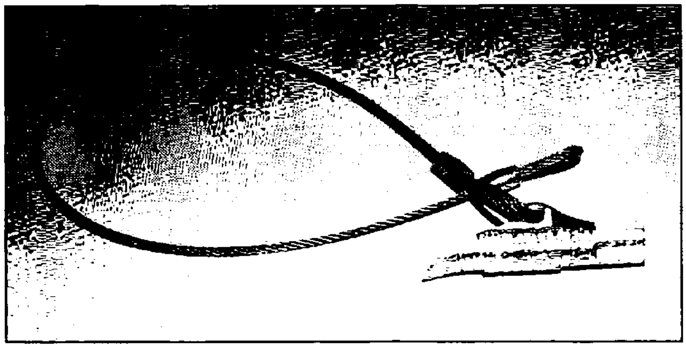


Photo A. The Duckbill anchor, when driven into the ground, provides a heavy-duty attachment point for your tower's guy wire.

Note, however, that the actual calculations of how much pull or force is exerted in your particular case should be determined by using one of the many computer programs that are available on the computer market today. They are fairly accurate and will give you the actual forces, pulls, etc. for the wind surface area of your particular installation at a given wind factor. Knowing this information is vital in determining the distance to place your Duckbills and guy wires from the tower base to insure the greatest holding power. You could also engage the talents of a physics major who just happens to be a friend, and talk him or her into performing the necessary calculations. I did both.

Foresight Products also offers a 5,000 pound Duckbill (Model 138-DB-1) for those of you who are lucky enough to have the space for a "Monster Quad." Needless to say, the holding power here would be 15,000 pounds. A few computer calculations indicated three of these 5,000 pounders would easily handle a 25-square-foot wind surface area antenna at 70 feet, with about a 3,000 pound safety factor. Again, your particular soil conditions must be taken into account.

Some might question the need for a 9,000- or 15,000-pound hold-down anchoring or guying system. I ran some figures through a few computer programs I had available. Unbelievably, a 40-foot-high tubular tower offers a projected 60-square-foot wind surface area, without the beam, rotor, or masting installed! Adding a beam five feet above the tower, or a total antenna system possessing a wind loading factor of only 15 square feet, causes some fairly heavy forces to be exerted upon the system. We are talking about thousands of pounds, not hundreds, of forces both horizontal and downward in direction, with an 80-mile-per-hour wind blowing.

These thousands-of-pounds figures can be quite unnerving, especially when that beam system is bouncing around during those 85 to 90 mph "hurricane" winds we're not supposed to have in Pennsylvania, or the "tropical storms" you do have in Florida, that we Pennsylvanians call hurricanes. Therefore, you can rest easily if you give yourself at least a 30% safety factor above whatever you calculate or the computer digitizes out.

Installation

Now that you've become a believer, let's discuss the Duckbill installation process. The Duckbill has an arrow forged into its body to indicate the side that is placed toward the earth (which is not the pointed side). Simple enough. The Drive Rod, Model DR-3 for use with only the Anchor/3000, and priced at $22.79 (only one drive rod is needed and will suffice for numerous installations), is inserted into the bill's body. The rod is then positioned to allow the bill to be angled toward the tower. You then use a sledgehammer to drive the 88-DB-1, Anchor/3000 into the ground at the proper spacing from the tower base. Foresight Products states that this is easily accomplished, even through shale.

However, if you decide upon the Model 5000, Foresight recommends that you rent a jackhammer for the installation of the Duckbills. Electrically-operated jackhammers are available at most retail rental outlets for a few dollars a day, and a small deposit. (Now you know how I really installed my smaller Model 3000 anchors.) Additionally, a heavier model drive

Photo B. The Duckbill can be driven into place with a sledgehammer and the DR-3 drive rod.

rod, GR-2 is required when installing the Model 5000 Duckbills.

In either case, the anchor is driven into the earth as shown until the loop is just a few inches above ground. An automobile jack can then be used to exert the necessary force to pull upon the bill's cable, making the bill rotate underground into its proper, horizontal holding position.

During the final rotation process, I used an automobile jack as the 3000's loop fit directly onto my jack safely and I was certain it wouldn't slip off. The object here is to exercise extreme care to prevent the cable from slipping and causing bodily harm. The jack is pulling upward upon the anchor cable with a tremendous force—probably over 3,000 pounds!—but it is necessary to insure the bill's proper installation.

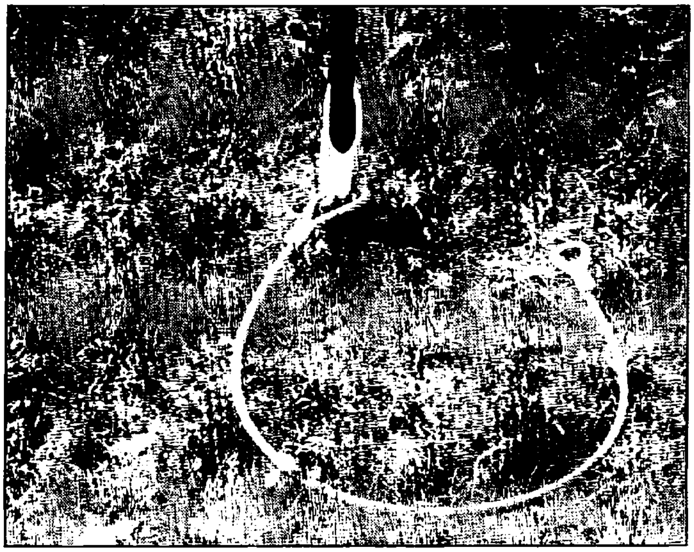


Photo C. The Duckbill is driven into the ground until the guy wire attachment loop (on the end) is just a few inches above the ground.

Once the Duckbill is in place, and it will be when you've pulled the cable three to four inches out of the earth, you're all set to install the first guy wire, turnbuckle, non-conducting cable, etc. The choice is yours from here on. Fortunately, you are now free from worrying about whether or not your tower installation is going to weather the next severe wind.

For more information, or to find your closest distributor, contact Foresight Products Incorporated, 6430 East 49th Drive, Commerce City CO 80022. They also have a toll free number: 1-800-325-5360

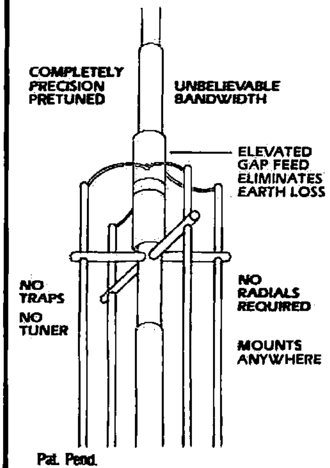
Happy "Super Guying"!

Number 15 on your Feedback card

UPDATES

Letters

Refer to the July 1992 "Letters" column, p. 2. The callsign for Joseph P. Esposito (the second letter) should read N2NEO instead of N2NSO. *TNX to William E. Woolverton N2NSO for the correction.*



A Simple Rooftop Vertical

An inexpensive and easy-to-build 40 to 10 meter antenna.

by Paul Stump NØLRF

If you don't have the real estate for wire antennas, or if you want to try vertical polarization for DX contacts, give this project a try. The only drawback is that it requires an antenna tuner to resonate on all HF bands, 40 through 10 meters. This is really an advantage, however, since the antenna can be band-tuned from the shack—instead of at the base of the vertical like some antenna designs. There are many tuners on the market and many more home-brew circuits in numerous publications. If you plan to experiment with antennas, sooner or later, you'll be glad you've got one.

The design criteria were:

• Reasonable cost: less than $60

• Visually unobtrusive: no guy wires or large supports

• Made from readily available components: hardware store

• Ease of construction: no special tools or talent required

• Maximum height above ground: rooftop

• Lightweight for safe installation

This antenna is best described as a vertical dipole. It is centerfed at the base of the rooftop vertical element with a ground wire running to a ground rod below it. This looks electrically similar to a conventional horizontal dipole.

All materials were purchased from the local hardware store except for the tripod, which came from a Radio Shack store. Some hardware stores carry these tripods, too. If your local hardware store does not stock the aluminum tubing, they should be able to order it. I know that ACE hardware stores can get it.

Construction

It is important that the three aluminum tubes fit closely within one another. This provides the rigidity necessary for the tubing to be one self-supporting unit and unlikely to kink under side loads. By close fit, I mean a diametrical difference (larger tube i.d. minus smaller tube o.d.) of approximately 0.020 to 0.030 inches. They should clamp easily using the stainless steel hose clamps and one hacksaw cut down the end of the larger tube.

Refer to the tube clamping detail and slot the medium and largest aluminum tubes down two inches from their upper ends using a standard hacksaw. With a pencil, mark the small and medium tubes twelve inches from their lower ends. Insert these into the medium and the largest tube to the pencil mark. Be sure to use hose clamps with hex-head adjusting screws. Clamp the three tubes together very securely using a ratchet and socket or a nut driver. Don't use a screwdriver to tighten the clamps because it will inevitably slip out of the screw slot and impale your other hand.

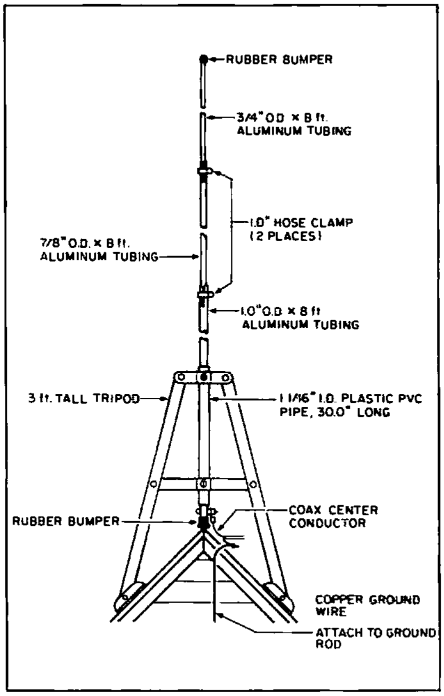


Figure 1. Overall diagram of the rooftop vertical.

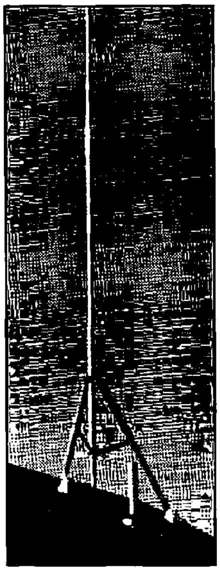


Photo A. The simple rooftop vertical.

Now drill a hole in the lower end of the largest tube, about two inches above the bottom. This hole should be just slightly larger than your brass screw. The coax center conductor will attach here later, but don't install

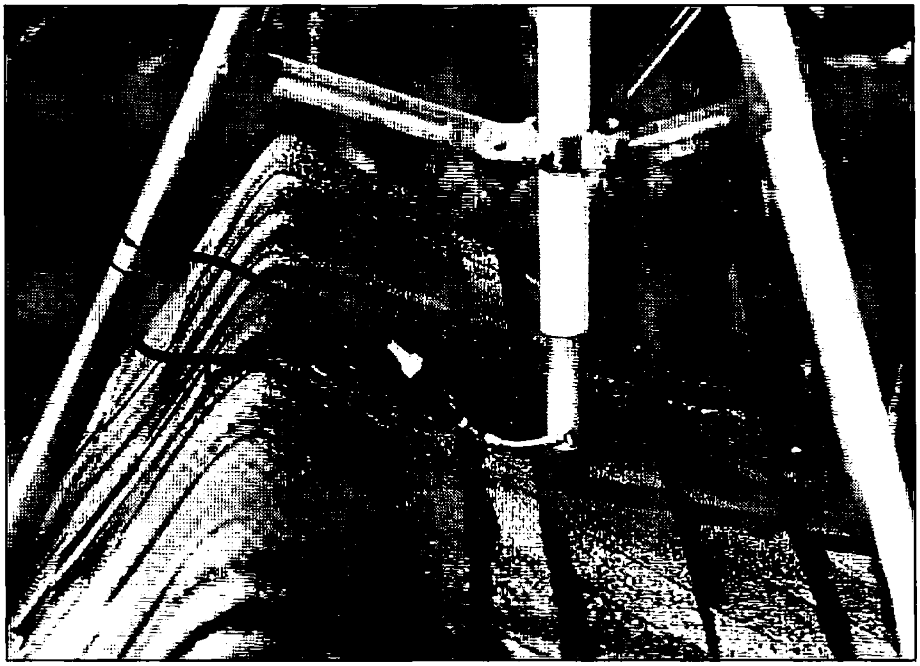


Photo B. Close-up view of the coax feedpoint.

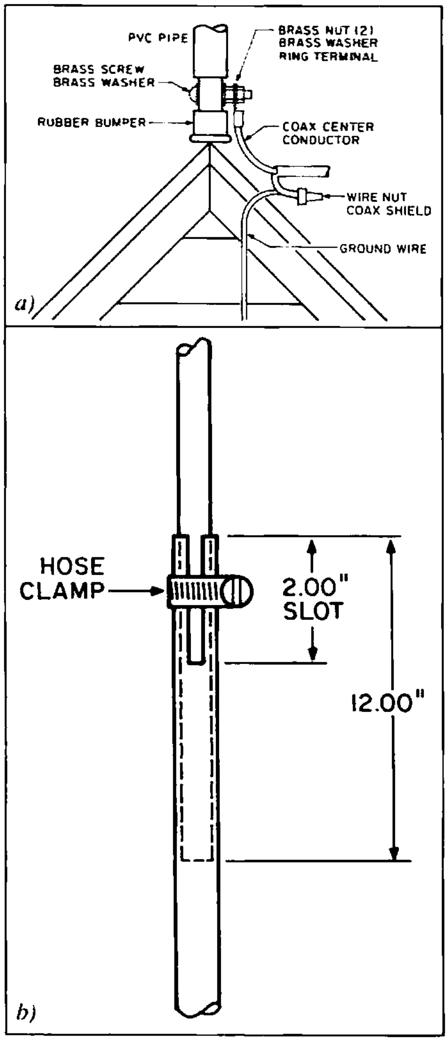


Figure 2.(a) Coax connection detail. (b) Tube clamping detail.

the screw yet. Install the rubber bumpers on both ends of the completed assembly. Be sure to drill a moisture drainage hole in the bottom bumper. This hole can be the same diameter as the screw hole you just drilled. You should now have a combined length of tubing (the driven element) 22 feet long.

Refer to the antenna assembly drawing. The assembled three tubes will float inside the plastic PVC pipe which is clamped into the tripod. This allows the driven element to flex enough to withstand the 50 to 70 mph winds we often experience here in Kansas. (Who says Chicago is the windy city?) With the PVC pipe clamped in the tripod and using a level to check for vertically plumb conditions, secure the tripod to the roof using galvanized or brass three-inch screws, two per leg. Adjust the height of the PVC pipe in the tripod so that it is about three inches above the roof to allow coax connection below.

Insert the aluminum tubing assembly in the PVC/tripod assembly from above. Remember, the aluminum tubing does not fasten to anything structurally—gravity holds it down. The lower rubber bumper rests against the roof. Insert the brass screw and one brass washer through the hole you drilled in the lower end of the antenna. Tighten the other brass washer and one brass nut on it.

I have found that you get what you pay for in many purchases. This is especially true when buying coax. Use only enough high-quality, 50-ohm coax (RG-8 or RG-8X) to reach inside the house and to your rig (maybe six feet extra inside). If this runs over three feet outside the house, somehow attach it to the house at three-foot intervals so that the wind does not whip it and damage it. Use coax staples or nails and ty-wraps. If you don't, the XYL will be greatly disturbed by the noise it creates in windy weather.

Meanwhile, back at the antenna, strip back three inches of the coax and crimp a ring terminal on the center conductor. Coat the coax with RTV or silicone bathtub caulk around the area where you have separated the center conductor and shield. Then cover this area with electrical tape or heat-shrink tubing. This is to prevent moisture from wicking into the coax. Attach the ring terminal to the brass screw with the remaining brass nut. Refer to any *ARRL Handbook* for proper coax connections and care.

Using a common household variety wire nut, attach the coax shield to a length of 12- or 14-gauge wire (solid or stranded), long enough to drop straight down the side of the house. Connect the ground end to a good ground rod (eight feet in the ground, if possible). Ty-wrap the the antenna end of the coax and the ground wire to a leg of the tripod to provide strain relief. As with the coax feeder run, attach the ground wire to the house every three feet or so. Install a PL-259 coax plug at the rig end of the coax and connect it to your antenna tuner antenna jack.

Safety

Now, let's jump start your common sense. Stay away from electrical services to your house—this thing is 22 feet long. Although the aluminum assembly is lightweight (less than 6 pounds), it is a bit awkward to manipulate on top of the roof. Therefore, practice on the ground lifting it up three feet as if you were inserting it into the tripod on the roof. Determine the best places to hold it and get a feel for its balance. Make sure your ladder is in good shape and be sure of your footing at all times.

Final Notes

I have not had much luck using the built-in antenna tuner in my rig with this antenna. However, I suspect one could adjust the length of the elements to find a compromise which would play with the limited capabilities of an automatic tuner. I have had great signal reports on 40 through 10 meters using an MFJ-989C tuner. This tuner will even resonate the vertical on 80 meters.

Although I haven't tried it yet, this might make a good portable antenna for Field Day, as the elements telescope into one another for transport. You might try using long gutter nails to fasten the tripod to the ground. Another application could be to mount it to the bed of a pickup truck and use the bed as a ground plane.

Parts List

Qty.	Description
1	3-foot-tail rooftop tripod
30"	1.063" i.d. PVC pipe
8'	1.000" o.d./0.900" i.d. (18-gauge) aluminum tubing
8'	0.875" o.d./0.775" i.d. (18-gauge) aluminum tubing
8'	0.750" o.d./0.650" i.d. (18-gauge) aluminum tubing
2	0.75" to 1.00" stainless steel hose clamp with hex head adjustment screw
1	0.75" i.d. rubber bumper
1	1.00" i.d. rubber bumper
1	10-24 x 1.50" brass screw
2	10-24 brass nut
2	#10 brass washer
1	8' ground rod
1	14 AWG/#10 ring terminal
6	3.00" galvanized or brass screw
1	12-gauge wire nut
1	PL-259 coax connector
AR	12 or 14-gauge ground wire
AR	RG-8 or RG-8X coax
AR	RTV or silicone caulk
3'	electrical tape or heat-shrink tubing
AR	coax staples
AR	ty-wraps
(AR = As Required)	
Required tools:	
	Hacksaw
	Pencil
	Measuring tape
	Electric drill
	0.201 diameter drill bit for brass screw
	Wrenches for tripod bolts & brass nuts
	Ratchet & socket or nutdriver for hose clamps
	Screwdriver for brass screw
	Level with 90-degree plumb bubble
	Crimp tool for crimp terminal

Number 17 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
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Peterborough NH 03458

Pick A Rig

So, those flashy magazine ads have finally gotten to you, huh? Now you're itchy to replace that 1974 HF rig with its drifty VFO and weak receiver. Well, today's rigs certainly are a whole lot betterl And, despite their higher prices, they're a lot cheaper, too.

What? Sounds pretty contradictory, right? Well, consider this: In real dollars, you are getting *far* more radio for your bucks than you did when you bought that old one. Sure, the new ones cost from $700 to $3,000, but the old ones cost from $300 to $800 and that money was worth a great deal more back then. And did your old radio have the stability of digital synthesis, a speech processor, automatic antenna tuner, memories, built-in dual VFOs, split frequency operation and all those other nifty features we've come to take for granted? Of course not!

OK, today's rigs are pretty neat. And they do cost lots of money. So, before you plunk down your precious cash, it pays to do some research, in order to be sure you get the radio you really want at a price you can afford. Let's take a look at what features and specs are typical of today's rigs, and how they differ among the various price levels.

Gimme Power

Most rigs produced today put out 100 watts of power. There are some expensive ones which can produce 150 watts and one or two which put out more than 200 watts. Does it matter?

Usually not. The difference between 100 and 200 watts is 3 dB, or one-half of an S-unit! And the difference between 100 and 150 watts isn't enough to notice at the receiving end. Far more important is the ability to control the amount of power. Some rigs have power output controls that work in all modes, while others let you adjust the output power only in CW, AM and FM, relying on the mike gain control to control it in SSB. Unfortunately, that method makes it very hard to keep the power below the level you want, because voice peaks can still drive the output quite high. But why do you care?

Gimme More Power

You care because you might want to add a linear amplifier one of these days, and most require maximum drive power to be less than 100 watts. Especially if you want to run the amp at less than its maximum power (to prolong the life of the amp or reduce TVI), you need to be able to control the output of your rig. If you think you might ever buy an amp, be sure to get a radio with an all-mode RF power output control. Yes, you can control maximum output using the ALC line which runs from the amp back to the radio but, unless the amp has *adjustable* ALC, you may not be able to set it where you need it. Also, ALC voltage and polarity are not standardized, and some amps don't control some radios very well. Some combinations don't work at all. In fact, many hams don't even connect the ALC line, although you should if you can, because it really helps avoid flattopping distortion and all the woes that brings.

Tuner Up

Nearly all new rigs have solid-state RF power amps. The convenience of being able to change operating frequencies without retuning the finals has made the tube final obsolete. Transistor finals have many advantages, but just one drawback: They cannot match a wide range of antenna impedances. If you have a great antenna system with a low SWR across all the bands you want to use, then it's no problem. If, however, you live in the real ham world and have a 3:1 SWR on 75m and want to use your 20m dipole on 17, then you need some method of matching the rig to the antenna. Today's solution is the automatic antenna tuner.

Sure, you can buy a manual tuner for under $100. You can even build one for much less. But now you're back to the old annoyance of retuning every time you move more than a few kHz. Heck, you might as well have stuck with tube finals! A much better approach is to buy a rig with an internal automatic tuner. With such a setup, you need only press one button and your rig will be matched in a second or two. Although you can purchase external autotuners, it is far nicer to have the unit built into the rig. While some radios come with the tuner as a standard feature, most offer it as an option. Buy it installed when you get the rig; it'll cost you a great deal more if you want it later. Typically, a rig costs about $200 more with the tuner, but the tuner alone costs $300 or more, and you still have to install it or pay someone else to do it.

The lowest-priced radios don't offer autotuners at all, leaving you with the necessity of getting some kind of external tuner. If you really need to save money, you can buy or build a small tuner and just live with the required knob twiddling. Heck, some hams, especially those raised on tubes, actually *enjoy* doing the adjustments. For me, it's just an annoyance. And I've seen more than a few tube diehards converted after five minutes of playing with an autotuned rig.

Can I Hear You?

Perhaps the single most important characteristic of any transceiver is the quality of its receiver. All of today's receivers have more sensitivity than you need on the ham bands, so don't quibble over the difference between 0.2 and 0.16 microvolts! But sensitivity is just one aspect of a receiver's quality. Far more important are selectivity, AGC smoothness, resistance to overload, and phase noise. All of these things contribute to the overall sound you'll be listening to. Is there really a noticeable difference between modern receivers?

You bet your sweet dipole there is. Even among similarly priced radios, you'll find tremendous differences. Some rigs are smooth-sounding and lovely to listen to, while others may distort voice peaks because of lousy AGC. Still others sound muddy and can literally give you a headache, thanks to phase-noisy synthesizer designs. Unfortunately, there's no easy way to tell from the published specs whether or not you'll like any particular receiver. The very best way to find out is to actually try the rig before you decide to buy it. Ham radio stores are a great way to do this, because often you can perform A/B comparisons, since the radios are lined up right next to each other. If you don't live near a store, though, you may still be able to try a radio out simply by asking around on your local repeater. If it's new, you can bet some local ham has one and can't wait to show it off.

Beware

Take brand advice with two grains of salt. Nearly every ham loves the brand of rig he or she owns and thinks it is better than the other brands. One ham will tell you that ICOM is the greatest, while another will swear by his Ten-Tec. The truth is, the satisfaction you will get from your radio can vary, not only by brand, but by various models within a given brand. In other words, you may love one Kenwood or Yaesu and hate another one. The only time it really pays to listen to anecdotal advice is when it concerns repair problems. If several hams tell you that their model XJ-1200 has had lots of PLL problems, it pays to avoid that rig, even if you get a good deal on one.

General vs. Specific

Most new radios have general coverage receivers. If you like shortwave listening, the wide coverage (typically 150 kHz to 30 MHz) will give you countless hours of pleasure. Having been a shortwave listener most of my life, I can heartily recommend that you give it a try. Some of the best news coverage in the world comes from the BBC. And if you have a multimode digital controller, you can copy news photos, weather maps, RTTY traffic and lots more.

There's a small price, however, to having a general coverage receiver: The overload rejection and some other receiver characteristics are not quite as good as they can be on a good receiver designed *only* for the ham bands. In my experience, though, general coverage receivers perform more than well enough; I've never had a problem. I suppose if I were a contester I might feel differently.

Bells and Whistles

Today's rigs have lots of knobs and buttons on them, with each new model attempting to outdo the last. If you're used to an old Swan, you're in for quite a shock! Looking at my TS-940, I count 47 switches and 19 knobs. Yikes! Do we really need all this stuff? Perhaps not, but a lot of it is really nice to have, even if you use it only once in awhile. Some of it is just pure marketing: 'They've got it so we'd better have it too." The ease with which a new radio can be learned and used, however, does not directly depend on the number of controls it has. Far more important is the philosophy behind its "user interface." In other words, the locations of the various controls and the sequences you must perform in order to carry out the operations. The user interface varies *tremendously* from manufacturer to manufacturer. The only way to know if you like it (and believe me, you will like some and hate others) is to try it. If you don't live near a radio store, try out a friend's rig. Even if it isn't the same model, its interface probably will be similar as long as it was made by the same company. Let's take a look at some of the available features and how much you need them:

RIT: Nearly all rigs have it. Some have a separate control, while others use the main tuning knob in conjunction with a button. The separate control is preferable.

XIT: Many rigs have it, although some low-priced ones don't. For normal, non-contest use, you really don't need it.

Notch Filter: Very useful. Lets you take out tuner-uppers and other heterodynes. If you really like a rig, though, and it doesn't offer a notch filter, don't pass the radio up on that account. You don't use the filter that often.

Attenuator: Lets you knock down the receiver's front-end gain. Sometimes useful on 75m in high-QRN conditions. You can live without it.

RF Gain: Lets you adjust the IF gain. Works somewhat differently than an attenuator. Some folks use 'em, but I never do; I just leave it all the way up.

Adjustable AGC: Handy. Most offer Fast/Slow selection, while a few also offer a medium setting or are continuously adjustable. Usually, you leave it in the slow position, turning it to fast only for CW and digital modes. Some

Continued on page 68

ATV

Number 18 on your Feedback card

Ham Television

Bill Brown WB8ELK
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70 Route 202 North
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The Flight of SPECTRA III

On March 21, 1992 at 7 a.m., the Franklin Community High School (Franklin, Indiana) Aerospace class launched their third high altitude balloon experiment. These experiments were part of a continuing school sponsored program aimed at teaching weather and communication satellite techniques. The students actually got a chance to design and build their own "satellites" and launch them to the edge of space with balloons to simulate the real thing.

Two Separate Flight Experiments

Two separate balloon payloads were launched from the baseball field at the school. The first balloon package carried aloft an actual aircraft transponder (donated by TERRA transponders of Albuquerque, New Mexico) and a 2 meter 300 milliwatt FM beacon (built by Dan N9KZH) with a tone-modulated CW ID. The second balloon package consisted of a Wyman Research ATV transmitter on 439.25 MHz with on-carrier sound, a 2 meter FM receiver, a 10 meter FM transmitter on 29.6 MHz, and a 100 milliwatt CW transmitter on 28.322 MHz. Anyone heard coming in on the 2 meter uplink would be repeated out on the ATV on-carrier sound frequency as well as the 10m FM output. The idea was to link up a number of classrooms across the midwest using the balloon as a crossband repeater. In addition to the amateur radio payload, a separate Samsung AF-SLIM camera was attached loaded with special infrared film. The camera was set up to take a picture automatically every 10 minutes. Thanks to the special film, a series of very detailed and spectacular photographs were obtained throughout the flight.

Liftoff

The first balloon (with the transponder) was filled with just enough helium to lift the payload and barely left the ground when it was released. It finally headed leasurely up towards the edge of space. The second balloon was filled with an abundance of helium and had plenty of excess lift. At liftoff, it zipped up at over 1500 feet/minute, almost as if it were helped along by a rocket.

Since the second balloon carrying the ATV gear and the crossband repeater was zipping along much faster than the transponder balloon, it reached its maximum altitude (about 90,000 feet) in about 1.5 hours. Along with spectacular aerial views of Indiana and the Ohio River, the crossband voice repeater saw a good deal of activity. Since the ATV transmitter operated with on-carrier sound (FM voice modulation of the center carrier) anyone with a 440 MHz HT could tune into the voice activity just by tuning into the center carrier of the ATV signal. At least three schools were able to work through the repeater and over 50 individual stations in a several state area were able to establish contact with the student-operated communications center at Franklin High School.

Recovery

The ATV balloon burst over extreme southeastern Indiana and the package plummeted back to earth when the parachute fouled up. Fortunately, the payload managed to just make it over the Ohio River to land near Warsaw, Kentucky. The payload was found just over an hour after the landing in reasonably good shape considering its rapid descent. Good ATV reception was reported in several Midwestern states and one school in Olds, Alberta, Canada, reported receiving not only the 10 meter transmissions but the 70 cm on-carrier output of the balloon repeater as well (a remarkable distance of 1500+ miles on UHF). The 10 meter CW ID was heard by Bill WA6YPE in Glendora, California, even after the landing (the 10m dipole was draped over two bushes).

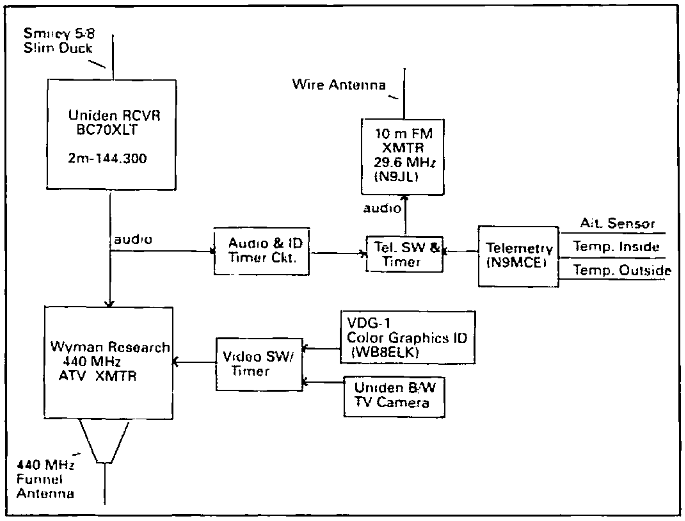


Figure. The FCHS balloon system diagram.

Long after the ATV package had landed, stations from across the Midwest reported hearing the very strong 2 meter FM output from the first balloon. Since the balloon was filled with very little positive list, it took over 3-1/2 hours to complete the flight.

Due to the increased flight time, the payload drifted across most of Kentucky and landed near the town of Isonville, Kentucky (over 180 miles from the launch site). The intrepid Indianapolis foxhunters finally located the payload hanging 70 feet up in a tree around 11 p.m. After numerous theories of the proper method for payload removal from the tops of trees, a local resident, Mr. Julian Fyffe, came up with the solution. He said, "If I were you, I'd chop that tree down!" Julian disappeared for a couple of minutes and reappeared with a chainsaw. He chopped down the balloon-eating tree in no time at all. All the chase crew had to do was walk up to the top of the tree and pluck the package from the formerly lofty branches. I understand that chainsaws are now standard equipment on any balloon chase.

A special thanks go out to the following flight sponsors: Wyman Research, Avex Portable Battery, Samsung Cameras, Terra Transponders, Milo & Assoc., Inc.

Thanks to Chuck Crist WB9IHS for the information in this month's column. His continuing support and advice to the Aerospace class at FCHS (as well as the many area hams who pitch in to launch and recover the payloads) has made this a very exciting program for the students. In fact, the design and launch of payloads is now part of the class curriculum. If you have any questions about starting a similar venture with your local school, feel free to contact Chuck at 6455 Madison Ave., Indianapolis IN 46227 (please enclose an SASE).

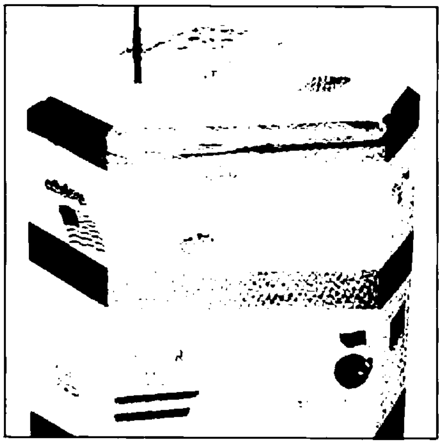


Photo A. The Spectra III ATV payload.

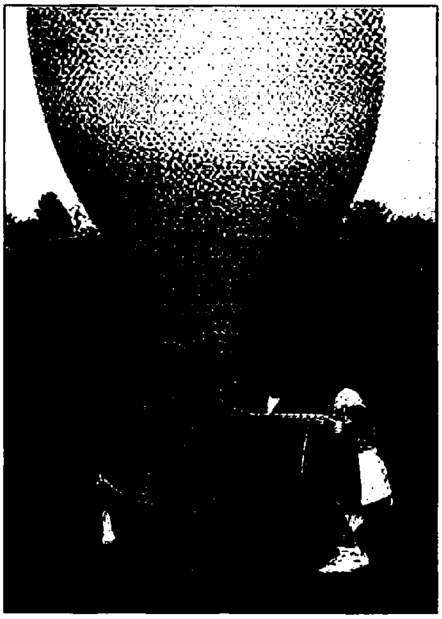


Photo B. The launch team inflates the first balloon. (l to r): Chuck WB9IHS, Pat WB9IQI, Seth KB4BGV and Darren Rasmussen.

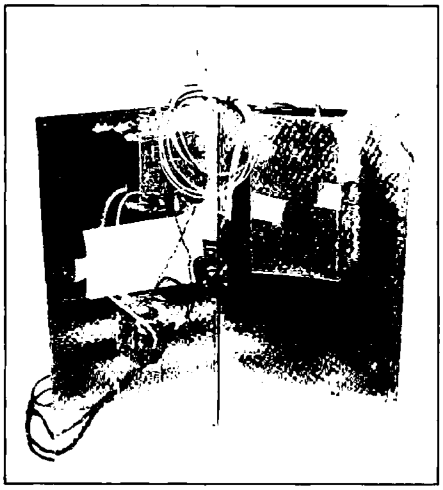


Photo C. Inside view of the Spectra III payload. All components were mounted on a triangular-shaped inner core which fit inside the styrofoam package.

Photo D. (l to r): FCHS students Andreas Sohmlein and David Smithers ready the Spectra III ATV package for liftoff.

The FCHS Balloon Team

Doug Craig	Project Manager
Chuck Crist WB9IHS	Project Director
Pat Crowe WB9IQI	Asst. Project Director
Ron Hamilton KA9VWR	Flight Communications
Dave Distler KN9E	Launch Program Director
Steve Smith WA4VWV	40 meter net coordination
John Goolby WJ9U	10 meter net coordination
Bob Rogers	FAA tracking/communications
Rick Tyre N9HLL	ATV downlink director
Mike Sercer WA9FDO	Video records
Seth Rossman KB9BGV	Launch team coordinator
John Lutz N9JL	Technical advisor (10 meter payload)
Darrell Sego KM9S	Technical advisor (2 meter payload)
Dave Latsch N9MCE	Telemetry coordinator
Mike Crist	Balloon fill/launch coordinator
Mike Rosemark KA9VMR	Weather coordinator
Ron Pogue KD9QB	Chase plane
Ken Jessup	Pilot of chase plane
Dan Trogglin N9KZH	2 meter transmitter beacon

Chase Team:

440 MHz

Tom Curran N9DZJ
Cliff Vaught N9FHF
Bernie Hefferman KB9AWS
Larry Oaks WB9YAJ

2 meters

Dan Trogglin N9KZH
Malcolm Mallette WA9BVS
Paul Bohrer W9DUU
J.R. Denney N9GWD

Students:
Darren Rasmussen
Sandi Winter
Tim Smock
Randy Miller
Kelly Puckett
David Smithers
David Young
Brian Ferns
Heather Kuntz
Jenny Reed
Chris Williams
Andy Bayliss
Lorne Whisler
Bob Bufton
Andreas Sohmlein
Chad Lamasters

RTTY LOOP

Number 19 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

As fall falls, and Labor Day lumbers by, let's take a dip in the "RTTY Loop" mailbag and see what we come up with.

The Rev. James Barton WØKNJ, of Colome, South Dakota, writes in response to the column last December regarding interfaces for VIC-20 and C-64 computers. Jim relates that for most of his 40 years in ham radio he was concerned with building gear that did not always function according to plan; or, if it did, may have not been the most presentable!

Just getting into computers, Jim picked up a VIC-20, and trotted down to his local Radio Shack to ask about computers and ham radio. Their recent push into ham equipment notwithstanding, Jim says that the look he received made him feel as though he were "some present-day Rip Van Winkle."

Well, Jim, we remain happy to be an alert and awake source of RTTY information. As you suggested in your letter, the G & G line of interfaces featured in the December column may be just the ticket for someone such as yourself who wants to put a VIC-20 or C-64 onto RTTY. I would not suggest you trash the VIC-20 for a C-64 just yet, though. Go ahead and put the VIC-20 online first, and see if it meets your needs. With a suitable interface and software you may well be perfectly happy. After getting on the air, let your interest level and desires dictate whether or not you want to move into the more complex equipment.

For those who may have missed the December 1991 issue, G & G Electronics offers the old Microlog line of interfaces for the VIC-20 and C-64 computers. Contact them here in Maryland at (301) 258-7373. Be sure to relate the source of your knowledge, OK?

Another puzzler is supplied by Bill Barbee AA5ZR of Grenada, Mississippi. Bill states that he has "been running RTTY for a few months now and have a problem with my set-up. I am using a Heath SB-1400 transceiver, MFJ-1224 interface for RTTY and CW, the MFJ-1265 software 9.1 April 1984, a C-64 computer, and a Commodore MPS-801 matrix printer. I have been using the C-64 and the MFJ-1224 interface to send and receive RTTY with my monitor. I have just purchased the Commodore MPS-801 matrix printer.

"My problem: I can't get the printer to print online when the RTTY signal is being received. I can get the print on my monitor, but the printer will not print simultaneously. After the buffer fills up, the buffer will dump the print on the printer. When this happens, the RTTY online information is lost. It will not receive and print at the same time.

"Is there something I can do to get the printer to copy online a RTTY signal? I love RTTY and I like to copy ARRL bulletins, but my printer will not print instantaneously."

Well, Bill, I have no current information, but seem to recall a similar problem with the C-64 and an earlier setup years ago. Could this be a design flaw of the system? I turn it open to the readership, and look forward to passing along whatever information I receive.

Speaking of information, a letter received from Lance Miller, Ph.D., AB4LP addresses the needs of quite a few of you. He writes, "I see by your column, in the August issue of *73*, that there is renewed interest in the old ASR-33. I have fond memories of this noisy, smelly, electro-mechanical marvel, and not-so-fond memories of attempting to discover information—any information—that would help me get the damn thing hooked up and functioning. I have empathy for anyone, especially neophytes, in the position of owning one of these gadgets, and attempting to use and maintain it. I'm convinced that more 33s have hit the garbage dump for lack of information than any other reason.

'There is a point. I have, on my bookshelf, the complete Teletype Corporation service manuals for the ASR/KSR-33, resplendent in their original blue binders. I will make these available to all who reimburse me for copying and shipping costs. One potential drawback—there are about 400 pages of material, and one never knows where the answer will be found in the manuals. In my case, I simply found the proper page and followed instructions. I'm not an expert on the 33, quite the contrary, so I can't answer specific questions; but the books are available, and they are complete.

"I haven't investigated copying costs yet. If anyone's interested, I'll shop around and get the best deal. This is a not-for-profit enterprise, but it's not a loss-leader either. I just hope that I can make life easier for some poor soul who is flailing around trying to get a 33 online."

This is a generous offer, Lance, and I am quite certain from the letters I have received in the past that there will be several folks willing to take you up on your offer. Drop Lance a line at 3123 Baird Avenue, Lakeland, Florida 33805-2118. Lance, thanks for you proposition, and please let us know further details as they become available.

While IBM compatibles and older Commodore computers take up much of our interest, one cannot forget that there are other systems out there. Dave Ventura KEØNA of Burnsville, Minnesota, has one of them. He writes, "I have been trying to find references or articles that would help me interface an AEA CP-1 to my Apple IIc computer. The CP-1 manual mentions that Apple II computers were once supported. I called AEA with the hope that the software and interface cable are still available, but they are not. A call to Kantronics and requests in local BBS systems also proved fruitless.

"I was hoping that you would be able to point me to any resources or references that may be helpful in my quest to get on RTTY with my Apple IIc and Yaesu FTDX560."

Well, Dave, I will throw the question out to the readers of this column. My experience has been that they often have the answer when conventional sources fail. Stick with us for a few months, and let's see if someone comes up with it.

Last month, Rick Arzadon posed a question about DesqView and running packet. Via CompuServe, Doug Stracener KA5YSY of Baton Rouge, Louisiana, relates that "DesqView is great, and runs much better than the Windows environment; i.e., it is faster and does not consume the memory or processor time. As to the question of what can handle simultaneous multimode contacts, I can highly recommend the Kantronics KAM and the Hostmaster II software. The Hostmaster II has a logging system and many other nice goodies, not the least of which is the ability to watch a DX cluster-spotting net and also be running RTTY, AMTOR or any other mode on HF port too. Since he asked the question about configuration, mine is as follows: 386/20 MHz IBM clone, 4 mB RAM, 105 Mb hard disk. My software is MS-DOS 5.0, DesqView with QEMM 386; the usual logger for me is Aries 2, which is a great terminal program with logging built in and is crashproof during contests. I also run Instant Track for the satellites, the Bearing program (which is an option with the Aries-2), and several other programs simultaneously. If Rick really wanted to get crazy, two KAMs into two COM ports would give the ability to run four different QSOs at one time on four different frequencies. Of interest to all is the fact that one of the built-in features of DesqView is the ability to cut and paste information between programs. This is a great feature if you need it."

Doug, I appreciate the information, and I am sure Rick does as well. Once again, the readers of this column come through.

Is there any interest in putting an old Flesher terminal unit to use with one of the popular RTTY programs? One scheme has showed up here, and I would be inclined to pass it along, if there is any curiosity.

I look forward to your input, as always, via mail, at the above address, or electronically via various services. Doug used CompuServe, my ppn is 75036,2501; others have used Delphi or America Online, my identifier on either is Marc WA3AJR. I look forward to hearing from each and every one of you this month.

Ask Kaboom

Continued from page 64

rigs do it automatically, some don't. Some even let you turn the AGC off. Now and then that can be nice with a weak CW station, but most of the time it isn't useful.

IF Shift, Variable Bandwidth Tuning, Slope Tuning: These all are methods for narrowing your IF passband to eliminate QRM from adjacent stations. An absolute must. VBT and slope tuning are better than IF shift, but that's OK too. I own a radio with no shift control, and it drives me nuts. For a while, there was a patent dispute in Japan which prevented some new radios from having the feature, but it has since been resolved, so newer models should have it.

All-Mode Power Output Control: As I discussed above, this is very useful if you are planning to get an amplifier. You can live without it, though, especially if you intend to keep your station "barefoot."

All-Mode Squelch: Occasionally handy, but not very often. Not worth worrying about.

Memories: They all have 'em. The more the better if you're an SWL. Otherwise, just a few will do fine.

Memory or Band Scanning: Absolutely pointless on HF. Don't waste your time.

Noise Blanker: Very useful in mobile situations or high-static base station locations. Some are better than others. Some offer an extra blanker for the "woodpecker" noise which used to emanate from Soviet over-the-horizon radar. The woodpecker no longer exists, but I suppose it could be used again in the future. An adjustable noise blanker is best, but some fixed ones work pretty well.

Speech Processor: Very useful. This can make your transmitter seem much stronger than it is. The RF or IF type of processor is best, but some audio processors are quite effective. Like noise blankers, adjustable processors are best, but fixed ones are OK too.

Monitor: This lets you hear your own signal after it has passed through the RF chain. Very nice for adjusting your speech processor. Otherwise not too handy unless your station develops a problem of some kind. Then it's a godsend.

Audio Peak Filter: This is the opposite of a notch filter—it peaks up a desired audio pitch while rejecting everything else. Great for CW, useless for anything else. Some peak filters "ring" and sound muddy, while others don't.

Full Break-In: If you're a big CW op, you may want it. Otherwise, probably not worth worrying about.

VOX: Some people love it. I hate it. I think it sounds annoying on the air. Are we really too lazy to press the TX switch?

Split-Frequency Operation: Needed for 10m FM, nice for some DX work. Most rigs have it, a few don't.

FM Capability: By law, only used on 10m. Since 10 is going "thataway" with the reduced sunspots, you'll have very little opportunity to use FM for a number of years. By the time the sunspots come around again, you may not even still own the radio! But, when the band is open, FM is a blast! Decide for yourself.

Whew, that was a long one! See you all next month.

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KICENI/OOV
PO Box 2508
Fullerton CA 92633

T-Hunting in the Beef State

For many hams, weekends mean uninterrupted hours in the ham shack working DX, contesting, packeting, or building new gadgets. But for many of my ham friends, weekends mean taking to the open road in a vehicle full of radio direction finding (RDF) equipment. Whether it's called hidden transmitter hunting, foxhunting, or T-hunting, the idea is the same: Find the hidden ham station with minimum time or mileage, to be the champion competitor of the weekend.

Mobile T-hunting started decades ago, but it's more popular now than ever, partly because of regular coverage in *73 Amateur Radio Today.* I hear from RDF enthusiasts all over the country, and it isn't hard to find hunters and hunt opportunities wherever I go. Such was the case in May when my wife April and I visited family and friends in eastern Nebraska.

One important stop was Lincoln, home of our alma mater (the University of Nebraska) and one of the most active ham clubs in the state. We had been invited by huntmaster Roger Hansen NØLIA to compete in the monthly Sunday afternoon transmitter hunt.

Times Change, for the Better

When I was a member of the Lincoln Amateur Radio Club (LARC) 25 years ago, there were no pocket handhelds or VHF repeaters. Nebraska hams kept in touch with each other on 75 meter single sideband, mobile and base. Statewide nets were held morning, noon, and night. That band was also where hidden transmitter hunts were held, but they were rare events.

A few of us college students, wanting to be "high-tech," tried out 2 meter FM using surplus RCA CarFones and GE "Pre-Progs." (This was before Wayne discovered it.) Their low-sensitivity 6AK5 front ends and battery-hogging vibrator power supplies made these sets as awkward as our 75 meter rigs, so no one dreamed of T-hunting on 2 meters back then.

New technologies have made great changes in ham radio life in Nebraska since then, but one LARC attribute remains constant—its members still show Midwestern friendliness and hospitality. As we got on repeaters and chatted with Lincoln hams, it was hard to believe over two decades had passed since we had moved to California. These folks have a way of making newcomers and visitors feel right at home.

Monthly 2 meter RDF contests have been going on in Lincoln for only a couple of years, so many hunters are still learning the ropes. I saw no dopplers or dual-whip RDF sets during my visit. Everyone used a yagi or quad. Simple through-the-window mast mounts (Photo A) were most common.

The most elaborate setup of the day belonged to Scott McCullough NØNID (Photo B). His home-brew quad uses a wooden boom and spreaders. The element spacing is adjustable to eke out the absolute best gain and pattern. It's too long for window mounting, so he built a wooden platform and pulley drive system to put it above the center of the roof (Photo B). Nice work!

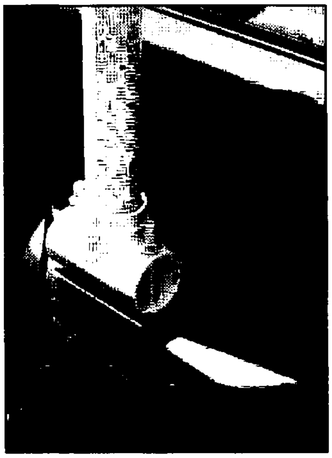


Photo A. Roger Hansen NØLIA came up with this novel idea for an armrest mount. The mast turns freely, but it took some filing to keep the fittings from sticking.

There is no requirement that the hidden T be in a vehicle, so contestants must be prepared for on-foot "sniffing." Most brought some sort of sniffing gear, such as KØGND's special yagi (Photo D).

Novel Rules

To win the LARC hunt, you must be the first to arrive at the hidden site. That's a common requirement for hunts everywhere, of course, but the Cornhusker hams have added a few interesting twists to the rules. For example, you are not considered to have found the T until you touch its microphone.

All members of the hunting team must touch the mike at the same time. Why all the togetherness? It prevents large teams from having an advantage over a single hunter in a sniffing situation. A car full of hams could be more efficient by scattering and doing a visual search. This rule encourages them to stay together and follow the RDF set's indications.

Another unusual provision in the rules helps hunters with inadequate means of attenuating strong signals. The hider must begin using reduced power when requested by one hunter. From then on, each two minute transmission is full power for the first minute, then low power for the remainder.

To keep interest high throughout the year, LARC invented a special scoring system. Fifteen points are awarded to the winners of each hunt, ten points for second, seven for third, five for fourth, three for fifth, and one for sixth and later.

If there are several hams on a team, each one gets the points. The club newsletter (called "The Lincoln Log," of course) regularly prints a running total of points for the year. This encourages everyone to keep participating and raise their standings.

The points are allocated to the hiding team at the start of the hunt, then awarded by the hiders to the hunters as they come in. For instance, if four teams are hunting, the hider starts with 37 points (15 + 10 + 7 + 5).

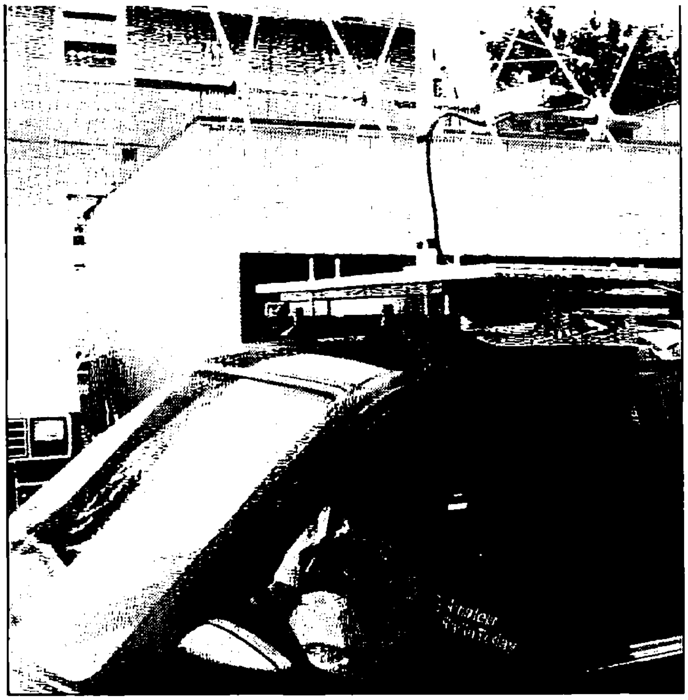


Photo B. Scott McCullough NØNID shamelessly sought recognition in this column by proudly wearing his 73 tee shirt. (It worked!) His RDF setup is a real eye-catcher.

If any teams do not find the T, they get zero points. Their points are kept by the hiders. Continuing the example, if two of the four teams are skunked, the hiders keep the 12 third/fourth place points. If all teams find the T, the hider gets only one point for his efforts—a consolation prize.

To get the most points, hiders work hard to keep from being found by anyone. Time is on their side because the hunt lasts only 60 minutes, maximum. Each transmission is two minutes long, then there is silence for three minutes. As RDFers know, you can make a lot of mistakes in those three-minute off periods.

Stealthy Signals

Another advantage for the hiding team is the unusual hearability rules. In the LARC hunt, there is no requirement that the fox's signal be copied at the parking lot of the Red Cross building, where hunters gather to start.

First contact is made on a repeater located two miles northeast of the start point. The T must be copyable through that repeater. Hiders get the names and calls of the hunting teams via the repeater, then they give the "go" signal. Hunters take off for their favorite nearby listening posts and listen on 146.52, awaiting the fox's first official transmission, which occurs five minutes later.

The fox can't make any changes to his setup when he QSYs to 146.52. But if the hidden signal can hit the sensitive repeater receiver without being heard near the Red Cross building, the hunters will face a serious dilemma. Running flea power and hiding close to the repeater will do it. But that's an obvious ploy—hiders will usually head for the repeater site right away if they don't get a direct signal at the start.

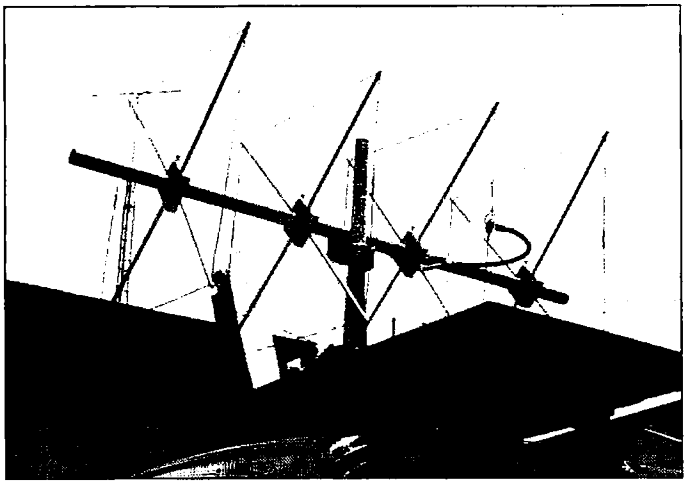


Photo C. Here's a closer look at NØNID's quad. The home-brew belt drive uses a bicycle inner tube.

Photo D. Reynolds Davis KØGND says this yagi was carefully designed to have the perfect pattern for sniffing out the fox.

In Southern California, where there are 5,000-foot mountains within the boundaries of many hunts, hiders can use the terrain for shielding. But there is barely a hundred feet of elevation change within the 80-square-mile boundary of the LARC hunt, so terrain shielding is hard to do.

On the day of our visit, the hiders tried a different scheme. KBØEK and NØQEC hid near the southeast boundary corner. They used a very low power T feeding a long quagi antenna, pointed at the repeater (Photo E). They elevated the beam, hoping to hit the high repeater receiving antenna with the lower part of the beam's forward lobe, without giving any signal to the mobiles at ground level.

The trick was a partial success Teams with sensitive gear such as long beams and GaAsFET preamps were able to get a smidgen of signal near the Red Cross building. On the other hand, one team with only a two-element quad drove for the duration of the hunt without ever hearing the T.

TBOX Update

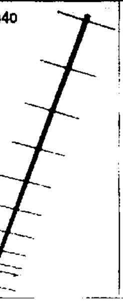
TBOX, the multi-featured fox controller, was described in "Homing In" for October 1991. Judging by the mail, it has been one of the most popular projects to appear in this column. An improved PROM BIOS code (version 0.8) is available on the *73* landline BBS. It has additional tone sequence modes and improved keyboard interrupting. The new BBS phone number is (603) 924-9343. Look In File Area 1 for TBOX08.ZIP.

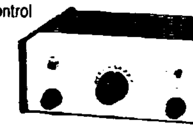
As with all microprocessor-based devices, hardware and software upgrades can make a good thing even better. Designer Ron Seese N6MBR has developed a number of improvements and enhancements. You can add a Dallas Semiconductor SmartWatch socket to program TBOX to turn on at a future time and date.

On/off timing and tone sequences can be changed remotely by a control link receiver and DTMF tones. There is a new mode to allow you to talk through the hidden T via the control link. A new version (revision B) of the printed circuit board is available from N6MBR.

Ron's mini-kit includes the board, a programmed PROM (v1.4), and the hard-to-find EEPROM. I just got it and I'm headed to the local jobber for the rest of the parts. For more information on TBOX enhancements and kit prices, send an SASE to Ron Seese N6MBR, 6136 Landino Drive, Westlake Village CA 91362. 73

Photo E. Hidden operators David Bunger NØQEC and Daniel Cowell KBØIEK (speaking) took pains to minimize extraneous signal leakage by putting RF chokes in the coax shield and covering the transmitter with a screen. Their long quagi antenna is on the sawhorse.





HAMSATS

Number 21 on your Feedback card

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

AMSAT-OSCAR-13 has been performing extremely well. Signals from our high-orbit, multi-transponder hamsat have been as strong as they were when the satellite was launched over four years ago. More DX stations have been heard operating through this satellite than ever. After completing my DXCC a few months ago, I am still working "new ones" without following the DX news. It is not uncommon to hear a relatively rare DX station that would be swamped on 20 meters, calling "CQ" for several minutes on the satellite before getting a reply.

AMSAT-OSCAR-10 inspired many DX stations to try satellite communications, but A-O-13 has surpassed A-O-10's popularity. Many DXpeditions have taken equipment along for at least Mode B (70cm up and 2 meters down) operation and some have been heard on Mode J (2 meters up and 70cm down) and even Mode L (23cm up and 70cm down).

Over time the orientation of A-O-13 with respect to the sun is modified to keep the solar panels fully illuminated. These changes require changes to the transponder-mode schedule. Table 1 shows the current operating timetable as provided by G3RUH, DB2OS and VK5AGR. The "MA" numbers refer to A-O-13's position in orbit and stand for mean anomaly. A MA of 0 or 256 is perigee, the satellite's closest location with respect to the earth. A MA of 128 is apogee, when A-O-13 is farthest from the earth. The terms Alon and Alat refer to the orientation of the satellite at apogee. When Alon and Alat are 150/0, the satellite is aimed at the earth before apogee. The best pointing angles (orientation of the satellite's gain antennas with respect to earth observers) correspond closely with Mode L and S (70cm up and 13cm down) operating times. This is necessary due to the narrow beam patterns of the satellite's microwave antennas. An experimental schedule with mode changes based on the day of the week in addition to MA counts was not well received earlier this year.

Table 2 presents the calendar of events for the control of A-O-13 through the end of the year and Table 3 is an element set for A-O-13, good for about six months. These orbital elements have been averaged from 10-element sets over a 90-day period by James G3RUH and provide excellent long-term accuracy.

As mentioned in previous columns, A-O-13 is scheduled to re-enter the atmosphere in late 1996 due to the gravitational effects of the sun and moon on the orbit. Until then we can expect excellent communications and a continued rise in DX and other activity through the transponders.

Field Day on A-O-13

This year's Field Day provided many newcomers an opportunity to observe and participate in satellite chasing via A-O-13. Long-time satellite enthusiasts forget the many hurdles they have overcome to get quality satellite communications. Equipment used on Field Day, from the antennas to the power source, represents the simplest configuration needed for contacts. All of the system components are usually out in the open for inspection by future satellite operators.

This year provided superior conditions for A-O-13 operation. The Mode B passband sounded like 20 meters. Excellent signal levels on 2 meters were heard by all during Saturday's evening hours.

Our group in South Texas used the call K5ERP (Effective Radiated Power) to make several dozen contacts on A-O-13 using the Cushcraft AOP-1 satellite antenna package, a Yaesu FT-736R transceiver, RG-8 coax and amplifiers from RF Concepts and TE Systems. Signals through the transponder were weaker than expected. Troubleshooting the system revealed some problems requiring immediate attention.

The Yaesu rig did not work well when voltages dropped below 12 VDC. The radio and amplifiers were on the same battery. Output was low and the SSB signals sounded garbled. This was cured by wiring radio power to a separate deep-cycle marine battery. Signals got better, but close inspection of the amplifier battery showed continued low-voltage levels. When a generator was brought online and connected to a power supply providing 13.8 VDC, power output increased substantially and quality voice contacts were pursued in earnest.

Experiments were performed with a Lightning Bolt 7-element quad for 70cm Mode B uplink activity. The Cushcraft 416-TB 70cm crossed yagi (wired for right-hand circular polarization, RHCP) was temporarily removed from the array to allow some quick comparisons. The small quad (described in last month's column) performed well. Received signal levels were within a few dB of those heard when using the crossed yagi. No spin modulation was noted. The small quad cannot be expected to exceed the performance of the larger RHCP yagi, but for simple portable work it is a good option.

Other Hamsats on Field Day

A-O-13 wasn't the only active satellite available for Field Day 1992. Many stations were heard and worked through Mode B on A-O-10, the Mode A transponder (2 meters up and 10 meters down) on RS-10, the analog J transponder on Fuji-OSCAR-20 and the digital modes of the PACSATS.

For a lucky few, voice contacts were made with KB5SIW on the Space Shuttle *Columbia* during mission STS-50. Dick operated the Shuttle Amateur Radio Experiment (SAREX) on 2 meters FM. His class and section were announced as "2C SPACE."

Continued on page 74

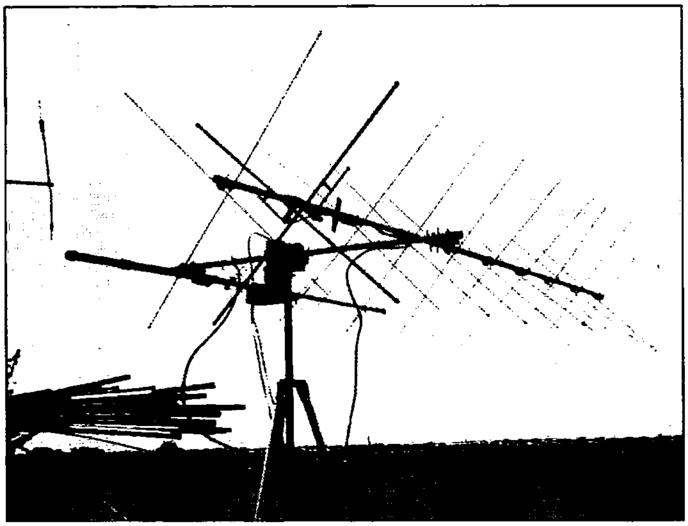


Photo A. The Cushcraft AOP-1 satellite array was mounted to a short tripod for satellite operation at K5ERP on Field Day in South Texas.

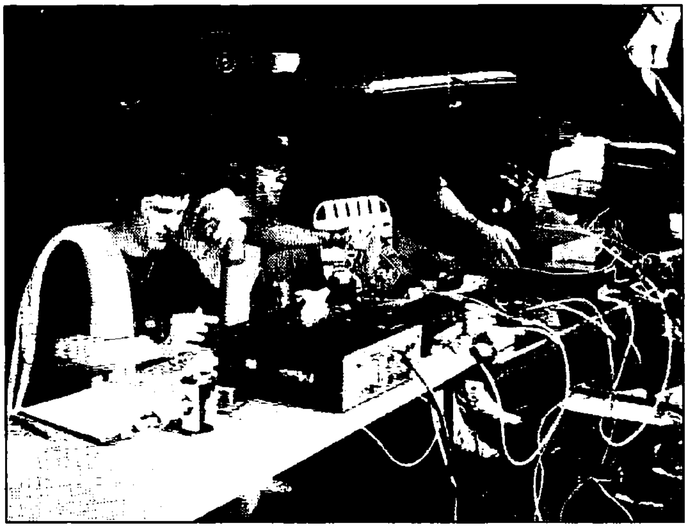


Photo B. Bob N5LCO modifies the Field Day satellite/packet station while Dave K5ERP works HF and Victor N5VPC observes.

Photo C. Some of the crew at K5ERP on Field Day 1992. From left to right down the table: KB5NZK, K5ERP, N5EM, N5XGW, N5RPQ and WA5LHM.

Hamsats

Continued from page 72

Table 1. A-O-13 Transponder Schedule for 17AUG92–21SEP92

Mode-B	: MA	0 to	40	from 1992 Aug 17 until Sep 21
Mode-S	: MA	40 to	50	- S transponder; B trsp. is OFF!
Mode-LS	: MA	50 to	55	- S beacon + L transponder
Mode-JL	: MA	55 to	70	This schedule operates
Mode-B	: MA	70 to	256	every orbit, every day.
Omnis	: MA	160 to	10	Alon/Alat 150/0

Please DON'T uplink to Mode B MA 40-50—this interferes with Mode S.

Table 2. Calendar of Events for A-O-13 for Remainder of 1992

Date	Event	Modes
1992 Jul 20 [Mon]	Move to 150/0	B
1992 Aug 17 [Mon]	JLS ON	B JL S
1992 Sep 21 [Mon]	Move to 180/0	B JL S
1992 Nov 23 [Mon]	Move to 210/0	B JL S
1992 Dec 14 [Mon]	JLS OFF	B
1992 Dec 28 [Mon]	To be announced.	

Table 3. Smoothed G3RUH Element Set for A-O-13

(Good for at least six months.)

Satellite	OSCAR-13 Smoothed
Epoch year	1992
Epoch time	151.596991 days
Inclination	57.0387 deg
R.A.A.N.	22.3910 deg
Eccentricity	0.730235
Arg perigee	287.1693 deg
Mean anomaly	10.1596 deg
Mean motion	2.097182 rev/d
Decay	0.0 rev/d/d
Revolution	3033
Semi major axis	25781.821 km
Perigee height	576.90 km

For those who didn't try satellite operation, there's always next year. A satellite station is a "free" transmitter for any group operating at least two HF rigs. In addition to the 100 point bonus for a single satellite contact, it is possible to get as many as a few hundred contacts with a well-managed station through the many hamsats in the sky. 73

CIRCUITS

Number 22 on your Feedback card

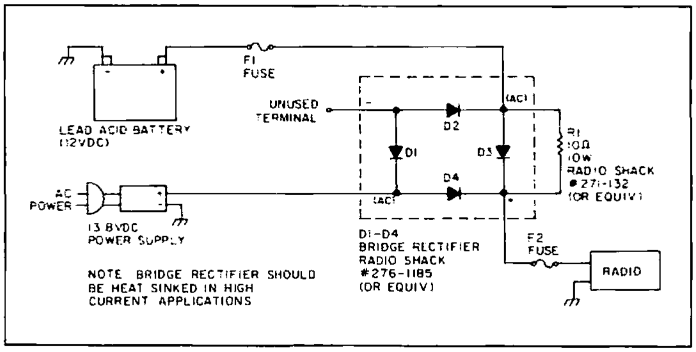


Figure 1. Solid -stale emergency backup supply.

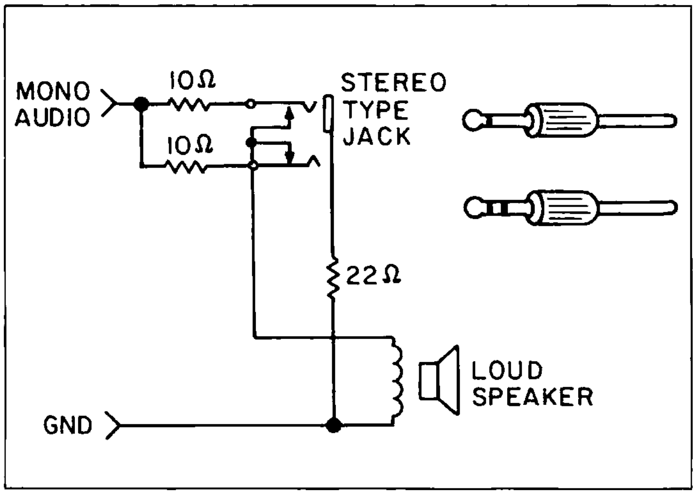


Figure 2. Mono or stereo type headphones may be used. Speaker is disabled when plug is inserted.

Solid-State Emergency Backup Supply

This circuit will allow any 12-volt radio or related equipment to continue to operate when commercial power is interrupted to the DC power supply. In addition, it will maintain a charge on the auxiliary power source. See Figure 1.

The bridge rectifier, F1 and F2, must be large enough to supply the maximum current drawn by the radio. R1 supplies a trickle voltage across the reverse biased section of the bridge while the power supply is in operation. This provides a continuous charge to the lead acid battery. Although a small voltage drop will be observed when supplying a radio through the circuit, satisfactory operation should result. Uninterrupted operation will be realized even in the event of a commercial power outage, without the radio "dropping out" at all. This circuit is being used in commercial radio installations with excellent results.

Butch Herring KE5V
Jonesboro AK

Adaptable Monophonic Output

Here's one that the foreign manufacturers are starting to use on portable receivers so that one may plug either a mono earphone or the now-popular stereo headsets into the same jack without an adaptor. Audio is provided to both tip and ring of the stereo plug, and the mono plug receives audio even though it shorts the ring connection to ground. Insertion of any plug disables the loudspeakers. A switch-type stereo jack (of any size desired) must be used for this adaptable monophonic output. See Figure 2.

Ron Johnson WA5RON
Austin TX

"De-Rippler" Eliminates Hum in Older Equipment

This "de-rippler" can be added to older unregulated power supply circuits to eliminate hum. Unlike a voltage regulator, it doesn't change the voltage much, and thus is suitable for adding to existing equipment. All parts are available at Radio Shack.

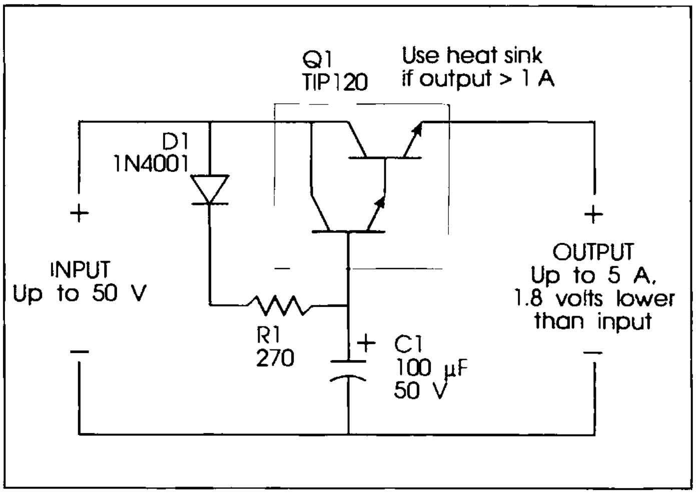


Figure 3. The "de-rippler."

Ripple must already be less than 1.8V peak-to-peak. If ripple is less than 1.2V p-p, D1 can be replaced by a direct connection, and the voltage drop will then be only 1.2V. See Figure 3.

Michael Covington N4TMI
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HAMS WITH CLASS

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Teaching the Teachers

For the past 12 years most of the teachers at my school would slow down their pace a little as they approached my room in order to better hear what was going on in "The Radio Room." If my eyes accidentally made contact with theirs, they would smile and quickly move on for fear of being invited to "come on in." Those few brave souls who were daring enough to cross the threshold into this unique classroom were rewarded with many surprising experiences. They've all been back many times since their first encounters. But, many of the teachers at Intermediate School 72 in Staten Island, New York, were afraid to inquire further about the ham radio program because they were intimidated by the unknown and were afraid of seeming ignorant.

Finally, this year, I got the chance I had been waiting for. Our school district sponsored a professional growth project and asked me to teach a course about how to use ham radio in the classroom. I knew the importance of this kind of exposure, so I really did my homework.

The course was to be given in two parts. The first session was designed to make the teachers feel comfortable in my room with the radio equipment, and to introduce them to the different aspects of amateur radio. I bombarded them with lots of handouts I got from the education department at the ARRL. Teachers always love to leave a workshop with lots of reading material that they can peruse later.

During the first session I also gave each teacher an outline of lessons that could be used to enrich their respective curriculum areas through the use of ham radio. At my workshop there were teachers from various departments of the school. We had social studies, science, language arts, ESL (English as a second language), art, and journalism teachers in attendance. I was able to give each one of them a highly motivational idea to incorporate in a unit of study through ham radio curriculum.

I left some time to do a live radio demo. They all enjoyed listening to various hams check in on the 2 meter repeater, but no one would volunteer to come to the mike. It has been my experience that adults are more reticent than children to get on the air for the first time. Well, after two or three lively conversations with some terrific hams who gave encouraging greetings to the teachers in my room, one brave soul, Larry Orange, a social studies teacher, went right up to the microphone for his first QSO. He was graciously welcomed on board by the ham he was in contact with. We all applauded him, and a great time was had by all!

As they left my room they were able to view some of my students' projects which were on display. Of course I made sure to have all the different disciplines represented in the exhibit. They were really amazed at the many applications there are in every major subject area. The interdisciplinary approach to education has always been the way I bring in the different areas of study. The 6th, 7th and 8th graders in my program are eager to learn the material because it's on a need-to-know basis. Geography isn't taught as an isolated collection of facts. In my room, the children race to the big wall map, or scramble for the atlas or globe to find out where the voice they're listening to on the radio is coming from. I firmly believe that this kind of learning is very meaningful because it is relevant to something they are interested and involved in.

I was pleased to see that there was animated discussion going on amongst the group as the teachers left my room. I told them to begin looking for opportunities to creatively use ham radio in a unit of study in their classes. One of the best comments I overheard was, "Now I see why the kids love coming here." I knew that these teachers were starting to see the possibilities of bringing some fresh approaches into their lessons for the students to have fun with.

The Second Session

During the second session I spent some time giving out information about the FCC license structure, and in discussing the various reference and study materials that are available. I also showed the ARRL video "The New World of Amateur Radio" so they could get a good overview of the myriad of activities ham radio has to offer. I spoke about my love for ham radio as a hobby and the great personal satisfaction I've gotten out of it.

Next, I showed them a video of the children in my classes having fun with ham-radio-related activities. The teachers of course recognized many of the students in my video ("Reading, 'Riting and Radio"). They were impressed with the way that even the "more reluctant learners" of our school were genuinely interested and involved in various projects with the radio. I pointed out that ham radio has something for everyone. The material can be adapted to be both appropriate to the slow learner and challenging enough for the more gifted.

Several special education teachers had joined our group, and were especially interested in the hands-on approach for teaching skills needed in the learning of Morse code. Amateur radio in the classroom affords the teacher the chance to use a multimedia approach to the curriculum. Supplying the students with code practice oscillators is a terrific hands-on activity. I have found that the special education students especially truly enjoy handling the oscillators and adjusting the tone and volume knobs. The special ed teachers were really excited about the way I explained how I teach auditory skills with the oscillators. Every child is forced to listen only to the student sitting right next to him. When 20 keys are all going on at the same time, it's no easy task to pick out the single tone you're listening for. It is truly amazing to observe the progress of the students as their listening skills improve through the term.


Photo A. Teachers having fun in the ham workshop. Left to right: Bill Flick, art; Larry Orange, social studies; Robin Gerstel, special education; Theo Zalantis, language arts.

I demonstrated each teacher's name in code, and then had them identify it on the board. Just as I do with the children, I made sure it was a fun experience. By the time they left the room that day, several teachers were already planning how they would be studying Morse code in teams. As a homework assignment, I asked each teacher to write up a lesson plan based on something they had learned in the ham radio workshop.

The Results

Arrangements were made for me to work with the social studies classes when the teachers would be introducing different regions of the world. We all agreed that it was a lot more exciting to be able to speak directly with a citizen of a specific area in the world than to just read about it in a book. One of the teachers, Norman Pianko, said he would be planning on working on interview skills so that his classes would be prepared to ask questions about the culture and background of the people his students could speak with on the radio. Another social studies teacher, Larry Orange, saw the immediate advantage in the area of current events with the radio. He was excited about the possibilities of speaking live with people who are in the midst of events like hurricanes, earthquakes, floods or plane crashes. He was intrigued as I told him how we had spoken with children in Los Angeles on the CQ All Schools net right after they had experienced a minor earthquake. He saw the advantage of children speaking directly to the victims or participants of a disaster, and then comparing their accounts to the media reports later on. Lots of good lessons to learn in this area.

The ESL teacher was fascinated by the obvious highly motivational opportunity to have a non-English-speaking child sit at the radio and listen to the different dialects and various languages that can be heard on the air. Peggy Koutsantonis said that her ESL students would probably love the idea of using Morse code to communicate with others. She could encourage them to give oral and written reports about hams they would be able to contact. She plans on doing lots of exchange lessons with me next term.

Iris Sweig and Theo Zalantis are language arts teachers who immediately saw the application to skills that they teach to the need to instruct children to speak clearly and succinctly on the radio. They loved the idea of having the kids exchange videos and letters with the other children they meet on the air. We all agreed that every teacher should be teaching good communications skills, no matter what their subject area may be.

Even if each teacher who attended that workshop includes just one unit relating to ham radio, it was all worth it. The teachers were challenged to incorporate new ideas and approaches into their curriculum. It was stimulating to consider new ways of motivating the children. I hope to have the opportunity to do more of these workshops.

If each of us can convince one teacher to enrich a lesson by using ham radio material, we will truly be making a difference in the learning of children. Please let me know how your attempts work out.

PACKET & COMPUTERS

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Tuning Up Your Packet Station

So you've got the TNC connected to the radio and the computer, and it works—sort of. You are starting to wonder whether part of the packet hobby is watching the LEDs on the TNC's front panel go on and off—'cause you sure spend lots of time doing that, compared to actually reading stuff from the computer's display. Well, don't despair, there are some things that you can do to tune up your station so that you can spend more of your packet time reading messages instead of LEDs.

You Are a Node on a Network

Many of the performance problems packet users experience are related to the LAN (Local Area Network) on which they are a node. To understand how this can come about, let's take a look at some of the base technology of packet radio. Amateur packet radio is based on a data exchange protocol (set of rules) called AX.25, for Amateur X.25. AX.25 is based on a principle called CMSA/CD—Carrier Sense Multiple Access/Collision Detection. Breaking down this important sounding term will make its meaning very obvious.

Carrier Sense: Any ham who has worked phone knows what this means: Just as you wouldn't try to talk over someone who was using a repeater, the TNC doesn't try to transmit if it hears someone on frequency. For some TNCs, this will mean any time the squelch breaks. Others provide better performance by listening for actual data and ignoring noise. This technique is called DCD, for Data Carrier Detect.

Multiple Access: This just means that more than one network node will use the data channel. While this may seem obvious from the radio point of view, when it was invented it was revolutionary. Think of the serial cable that runs from your TNC to your terminal—prior to schemes for multiple access, this is how all data communications was done, one-to-one.

Collision Detection: While the TNC will listen to the channel to avoid transmitting over another station, there are at least a couple of conditions where two stations will transmit at the same time. The most common situation is where two stations can't hear each other. In this case the TNC will assume that the frequency is clear, and will transmit whenever it has a packet to send. A third station, say a PBBS, can hear both stations—and so a collision occurs. This is sometimes referred to as "hidden transmitter syndrome."

The second situation is where two stations that can hear each other find the frequency clear and decide to transmit at exactly the same time.

AX.25 can detect collisions because part of the data packet—from which packet radio gets its name, but more properly called a frame—is a checksum. A checksum is the result of a mathematical operation performed on all the data in the frame. The receiving station performs the same calculation, and if the received checksum is not the same as the calculated one the packet is discarded. The receiving station then requests a retransmission of the packet, repeating the process until a complete packet arrives. On a wire, a collision is just about the only thing that can damage a packet. On the air, noise, fading, and collisions can all damage packets. These retries are one of the biggest channel and time wasters in the packet world.

Because you are a network node, what you do affects everyone else. It is very important to keep in mind that the LAN is a resource shared by everyone, and anything you can do to improve your station's performance helps everyone else, too.

Speak Up, and Listen Carefully

Many of us use a hand-held radio for our packet station. It is convenient, and besides, it's a good excuse to go out and buy a newer model to carry around. There is nothing wrong with using a hand-held radio, but keep in mind that the ideal situation for the packet LAN is that *every* station hear every other station. Think about your handheld: Is it three watts? Five? It is not just important that the PBBS hear you—remember the Carrier Sense part of CMSA/CD. If the PBBS hears you, but other stations don't, *you are a hidden transmitter!*. Ever wonder why your station sometimes times out with a "retry count exceeded" message? Hidden transmitters! You can't hear them but your PBBS can and, being a very polite sort of PBBS, it is going to wait until the channel is clear before sending you an ACK (ACKnowledgement). It waits so long, in fact, that your poor TNC figures it's gone, and disconnects. Hidden transmitters are one of the biggest problems for the packet LANs around the US.

To keep your station from being a hidden transmitter there are a few steps that you can take. First, put up the best *omnidirectional* antenna you can manage. While a beam may let you hear the PBBS—and it hear you—really well, remember the point of the discussion above: It is just as important that the other LAN users hear you, too.

A nice antenna that can be had cheap is a J-pole. It is easily built from almost any sort of metal tubing and works very well. You'll find plans for J-pole antennas in nearly any antenna book, and in back issues of *73*. If you don't feel like building an antenna, and you don't mind spending a bit of money, antennas like the AEA IsoPole or the Cushcraft Ringo Ranger are available from any amateur radio dealer and work very well. Whatever antenna you use, put it up high. VHF communication is pretty much a line-of-sight affair; the higher you get that antenna, the farther you can talk.

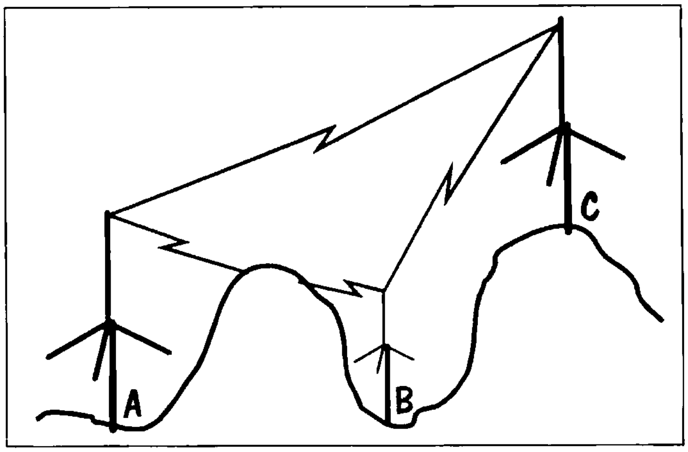

Figure 1. While the PBBS—at station C—can hear both stations A and B, they cannot hear each other. Since each is hidden from the other, they cannot tell if they are interfering with each other's transmissions (Carrier Sense). If the station at C were a repeater, A and B would not compete, blindly, for the frequency. See the text for more information.

Once you get yourself the best possible antenna, it may be time to consider an amplifier. Depending upon the area covered by your LAN, it may be necessary to run more than the five watts your handheld can manage. You might also consider getting a used mobile rig at a hamfest, but if you do, try to get something relatively new. The switchover time between transmit and receive on older rigs may make them difficult to interface with the TNC. Once you have a good signal out there you can consider some other factors that might effect your packet performance.

Cooperation

Because packet depends on all of the LAN's users to get good performance, local cooperation is very important. Even if you have a wonderful signal, a single hidden transmitter can ruin your packet day. This is where local packet organizations come in. If you have one, join it. If you can, and are so inclined, get on the technical committee. Help packet newcomers to get a good signal on the air. There are some things that a group can do to help make things better for everyone. For example, there are some parameters available in the TNC-2 firmware which were developed by Phil Karn KA9Q. These parameters—PPersist and Slotime—help make the stations acquire the channel more randomly, reducing collisions, but this only works if everyone uses them.

Repeaters

A repeater—like the kind used for voice operation—makes an enormous improvement in LAN performance by effectively eliminating hidden transmitters in its service area. Even low power stations are heard by everyone since they go through the repeater

For packet, a system that regenerates the digital information is actually better than a normal audio repeater. This type of repeater is almost identical to a voice repeater but instead of just passing the audio from the input to the output, it reads the digital information on the input and regenerates it—transmits its own clean version of the bits—on the output. This is very similar to what some repeaters do with DTMF and CTCSS tones.

If repeaters are so great for packet, why aren't there more of them? I'll give you a one-word answer: money. For some reason we are perfectly happy about—in fact, often insist upon—giving money to support our local voice repeater. Yet somehow, when it comes to packet, we expect the sysops to foot the bill. Think about it: When was the last time you wrote out a check for the local repeater organization? Your PBBS sysop? Why not send ten or twenty bucks to the guy who spends lots of time and money to make sure that you can read your packet messages and mail? If we can make it normal to pay for packet access, then maybe we can start putting up repeaters and getting serious about our LANs. The money is not going to magically appear—it's got to come from you.

Portable Packet

I get involved in helping during disasters whenever I can, so portable packet stations are of great interest. How many of you are doing portable—or mobile—packet? N1EWO/M consists of a Heath HK-21 portable TNC and a Yaesu FT209-RH handheld. The terminal is variously a TRS-80 Model 100 and a number of different notebook computers that move through here. It has two battery options. First is the normal NiCd pack for the radio and a 12-volt pack that I built for the TNC (the internal battery was too expensive). The second is based on Gates Cyclon battery packs. These are sealed lead-acid batteries—not GelCells—with some really exceptional properties. One of these 5 Ah batteries will run the station for several days of intermittent use. If you are doing portable packet, what is your station like? How do you power it? I am very interested in what people have come up with.

Talk to Me

I really want to make this column what you—the readers—want it to be. Don't be shy; tell me what you like and don't like about it. I really need your feedback to make this an information resource for *73* readers. I am interested in any questions, or ideas for future topics, that you might have. Thanks for reading and 73 de N1EWO.

Number 25 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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Surplus Equipment 10 GHz Amplifier

Last month I covered component parts and a 12 GHz LNC modified for the 10 GHz amateur band. One question surfaced concerning that column. Just what is the difference between an LNA and an LNC?

An LNA is just an amplifier for the frequency in use, hence Noise Amplifier (LNA). An LNC (Low Noise Converter) is an amplifier, mixer and converter assembly all contained in one remote antenna-mounted unit. LNAs are common on the 0.7 to 4.2 GHz satellite bands while LNCs are the In thing on the Ku 12 GHz satellite band. LNCs must convert to a lower frequency for transmission on the coaxial feedline to the station equipment. The loss on a length of coax feed cable at 12 GHz would be quite excessive! With that cleared up, let's get on to this month's topic.

This month let's cover another useful microwave component that is available from the surplus market: an Avantek quarter-watt power amplifier. The neat thing about this device is that it can be modified for 10 GHz operation. This item was advertised in the Apnl '92 issue of *Nuts and Volts.* It was the featured item on the inside of the front cover, titled "14 GHz Satellite Antenna Bits." The downconverter (last month's "Above and Beyond" column), as well as the Avantek amplifier (this month's column), were offered for sale. I hope you did not miss this bargain as I believe Halted Specialty, who ran this ad, was swamped with requests for these items and they ran out of stock on some. I know that the amplifiers are gone and I hear Halted would like to have more to sell.

For those who picked up on this item, you will be pleasantly surprised that both items can be converted to our 10 GHz band with a little effort. Specification wise, the Avantek 14 GHz module, as Halted advertised, is Ku band, 14 to 14.5 GHz, 0.25 watt output with SMA coaxial connectors. The unit has both monitor and power detection outputs. The great part is that it operates on +12 to +15 volts DC. The unit is brand-new and measures 4" x 8" x 1" high. Halted wanted $24.95 for the unit—what a bargain! I believe the amplifier was designed for satellite service, such as gas pump credit card transactions, and was an early design. Manufacture dates on the units that I obtained varied around 1986, so the design was not too old.

Kerry N6IZW was the first in our San Diego Microwave Group to spot the ad and order an evaluation unit. Kerry was instrumental in retuning the first unit to 10 GHz with the same power output as was normally provided at 14 GHz. Needless to say, we ordered more units. Remember, from the last month's column: Don't jump into something until it's been evaluated. Well, this unit proved so hot we got a daily quantity report from the many different amateurs who were placing orders for iL

We helped spread the word, and it went around so fast we even received some calls alerting *us* to the item. The word spreads fast when it's a premium useful item available. I heard a rumor that one sale of these amplifiers was for 100 units in one transaction. I don't know where all of these amplifiers went, but the original quantity must have been substantial. Let's get on to the meat and potatoes of this unil.

The Avantek amplifier enclosure is a machined box that has a cover plate fastened with a multitude of screws. The cover can be removed quite easily, but you might have to pry gently with a knife edge to break the seal of the rubber gasket under the cover plate (with the screws removed). With the cover plate off you can see the three-stage power amplifier running along the top of the amp. The bottom compartments contain the power supply and power monitoring circuitry. Differences have been noted on several of the amplifiers we observed. We feel these were due to changes in design. This difference is not of much concern as most of the units noted are the old design.

The difference (old to new) can be verified by looking at the top right side of the amplifier at the circulator, amplifier portion of the circuit pointed up. The old design has a metallic square circulator, while the newer circulator looks like a ceramic device in the same spot. Performance-wise the newer unit can deliver a dB or two more than most of the older units. From the outside of the units, the break in units (old to new) seems to happen around serial number 5600. In reality, both units work well and this is a minor difference.

The first priority before starting modifications is to set up a static-free work station on which to do the actual circuit changes. Use a ground plate to hold the amplifier and ground all instruments to this plate. That includes your soldering iron (low voltage temperature-controlled type desired here). Ground yourself with an approved wrist strap, not a direct connection to ground. Most wrist straps have a megohm or so in the leads to prevent an accidental direct connection between yourself and the common ground. This prevents a high current conduction through you. The idea here is to discharge slatic, NOT LIGHT UP YOUR LIGHTS.

Back to the modifications. The original adjusting tabs that were used to tune the amplifier (stripiine) to 14 GHz need to be removed. These tabs were added at the factory to adjust the unit for peak performance at 14 GHz. When tested after the tabs were cut away with an X-acto™ knife, the amplifiers modified to this point gave between 5 and 10 dB of gain at 10 GHz. The important thing is that there is something to see (gain at 10 GHz) before actual modification.

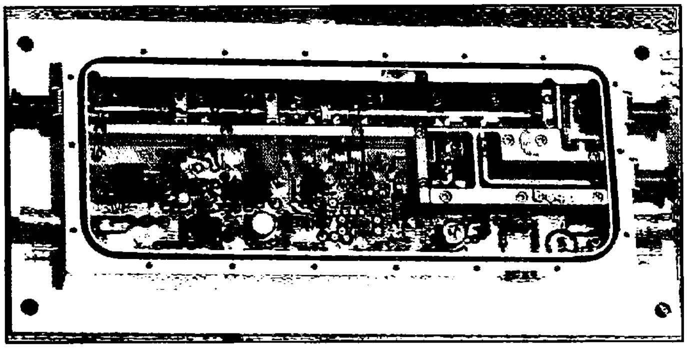

Photo A. Original unmodified Avantek quarter-watt power module.

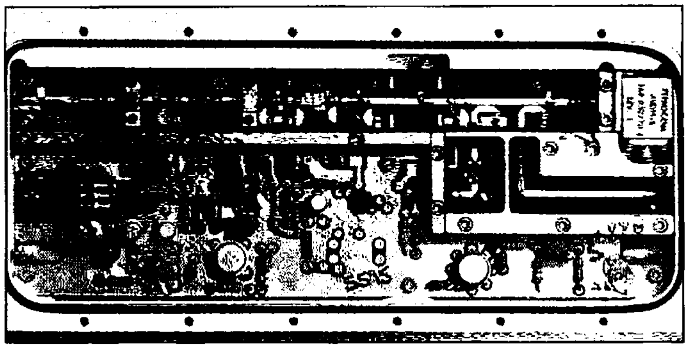

Photo B. Modified Avantek power module, with only the top portion (amp circuitry) modified. No change to the power supply circuit.

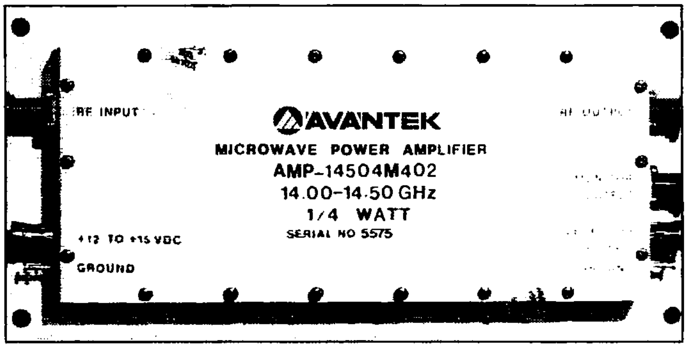

Photo C. Outside case of the power amp.

The procedure to retune the amplifier at 10 GHz is made in small steps using wooden toothpick tools. The toothpick tools were made by cutting a flat end on one end of the round toothpick. Superglue a small piece of copper (snowflake size) to this end of the toothpick. Several of these were constructed and graded as to size of the copper snowflake.

Place the tool on the stripline at various points to determine where similar-sized permanent copper stubs are to be affixed. Toothpicks in several sizes can be used to find the best copper tab to use for best gain. By having several sizes of copper toothpick tuning tools we can duplicate what size of copper bit Is needed on the stripline to adjust to 10 GHz. This optimization is done with power applied, but at reduced input levels (drive) so as to not have the amplifier at full output power.

Kerry used -15 to -10 dB input drive during this adjustment phase. Note the output gain achieved with the toothpick and then remove the DC power/drive. Then, in a static-free involvement, a similar copper snowflake as the toothpick tool had placed on the stripiine exactly where previously noted. Solder tack it to the stripline and relest with low drive power and DC applied. Check for similar power gain as noted before. If it is OK, proceed to the next stage or stripline section and check for gain with the toothpick test tool at this new location until you are satisfied with unit's performance. There will be some interaclion with tuning and all must be rechecked for final adjustment. Most amplifiers yielded an overall gain of about 24 dB.

Just where to place the copper bits to retune each amplifier will vary from amp to amp. We have found that the tuning will go something like this for tab insertion, and this too will vary from unit to uniL The input stripiine almost at the input connector needs a tab added first. First amp stage: not much to do here. Second stage: nothing noted at the input but requires a large tab on the output right at the device for the best gain at 10 GHz. Third stage (final): has a very thin input line width; needs to be wider and have a lab attached for best gain. The output needs a very wide line/tab added. The output stripiine towards the circulator needs to have tabs added about 1" and 2" away from the output stage for final gain adjustments. Be careful when placing tabs and line width copper bits near the

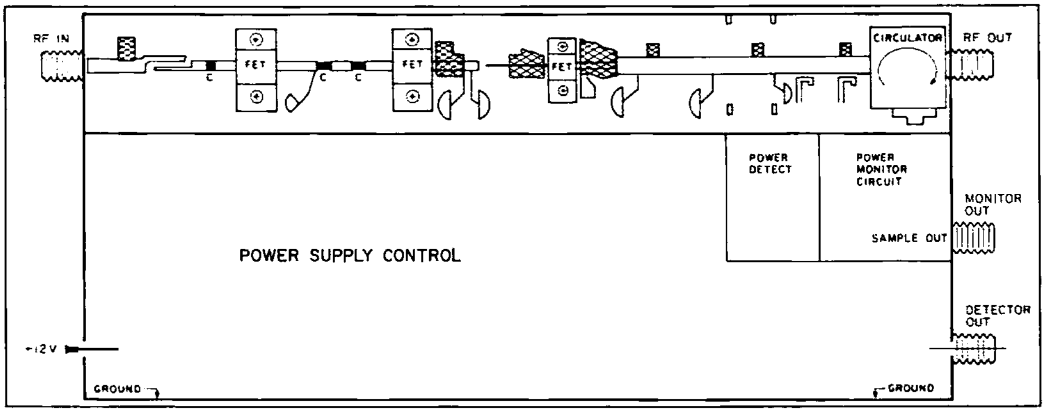

Figure 1. The Avantek microwave power amplifier, originally 14-14.5 GHz, modified to 10.368 GHz. Crosshatched areas indicate the position of the copper "snowflakes" soldered to the stripline. The exact position must be determined by testing.

devices—inspect them before applying power. I suggest using a high power eyepiece to check everything. Remember—take your time; it's just like cutting a piece ol wood. You can measure two or a dozen times but you can only cut once! GaAsFETS do not like static or shorts with power so be careful.

Soapbox

I have a friend who runs a computer-oriented business in San Diego. He has been very instrumental in getting me up and running on the IBM computer systems and away from my old prehistoric CPM-based systems. He is very high-tech and has offered some memory space on his information retrieval systems which are fax-based. How the system works is quite Interesting. Just phone up the system and all operation is totally voice Integrated in selection. You confirm direction on the system by touch-tone answers to the system's voice questions.

After selecting the particular document you want you place your fax machine in the receive mode and off it rips at 9600 baud. This system is quite sophisticated. We are not talking text but high quality photographs and schematics, all computer generated, are possible. When time is available we plan to try some artwork transfers. The trial tests look so good they don't even look like the normal faxes I am familiar with. This system is in communication service and I will be glad when it is online assisting our amateur applications.

Some time will be devoted to testing such things as dimensional stability and aspect ratio, and length-to-width scan dimensions. After some testing I hope to have this service up and running for your use. The exciting thing is that this is not a one-line telephone based system, it's multi-line so quite a few users can operate the system at the same time. We're talking a very big system here. More on this later when we have some files set up.

Newsletters from Great Britain

There are several newsletters for microwave operations that have been forwarded to me for information. The first is a monthly newsletter from Lambda House, Cranborne Road, Potters Bar, Hertfordshire EN63JE, England. This is a monthly publication from the Radio Society of Great Britain, edited by G3PHO and G8AAGN. The April '92 edition that I received covered several construction projects. One had modifications to an oscillator board for a multiplier at 2.5 GHz for a 10 GHz transceiver. Another article covered a very unique method of power supply conversion, converting 12 volts to +20 volts at 400 mA. Also, it provides -5 volts bias at 50 mA. Other articles covered news and views from "the world above 1 GHz." Quite a nice newsletter.

The other newsletter is the "VHF/UHF DXer," c/o Dave Hardy G8ROU, Thorntree House, Wensley, Matlock, Derbyshire DE42II, United Kingdom. This newsletter covered microwave kits' availability and news and operations TV DXing, the results of a local noise figure measurements contest and a few construction articles. The cost of this newsletter is $14 a year for bimonthly distribution.

A U.S.-based newsletter, the "AMRAD Newsletter," is devoted to amateur radio and computer experimenters. They advocate experimental designs and promote ideas and the dissemination of such information through several means, the newsletter and the computer bulletin board. Their BBS is operated by Lawrence Kesteloot N4NTL (703-734-1387) 300, 1200, 2400 baud, 8 data bits, 1 stop bit and no parity. Their newsletter further identifies services to the handicapped and a repeater on 147.81 in 147.21 out that is located in McLean, Virginia. This month's topics, two of my favorites, are lasers and 10 GHz conversion covering the Radio Shack "Flavoradio" which is used in an IF amplifier application for 10 GHz. Membership in AMRAD is $15 a year. They give honorariums of one-year-free membership for original material accepted for the newsletter. Their address is Editor, "AMRAD Newsletter," P.O. Drawer 6148, McLean VA 22106.

This amplifier conversion is just the application for expanded/detailed information to be placed on the fax system. Let's get it up and running for my applications and I will let you know all the details on its operation. As always, I will be glad to answer questions concerning related topics. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

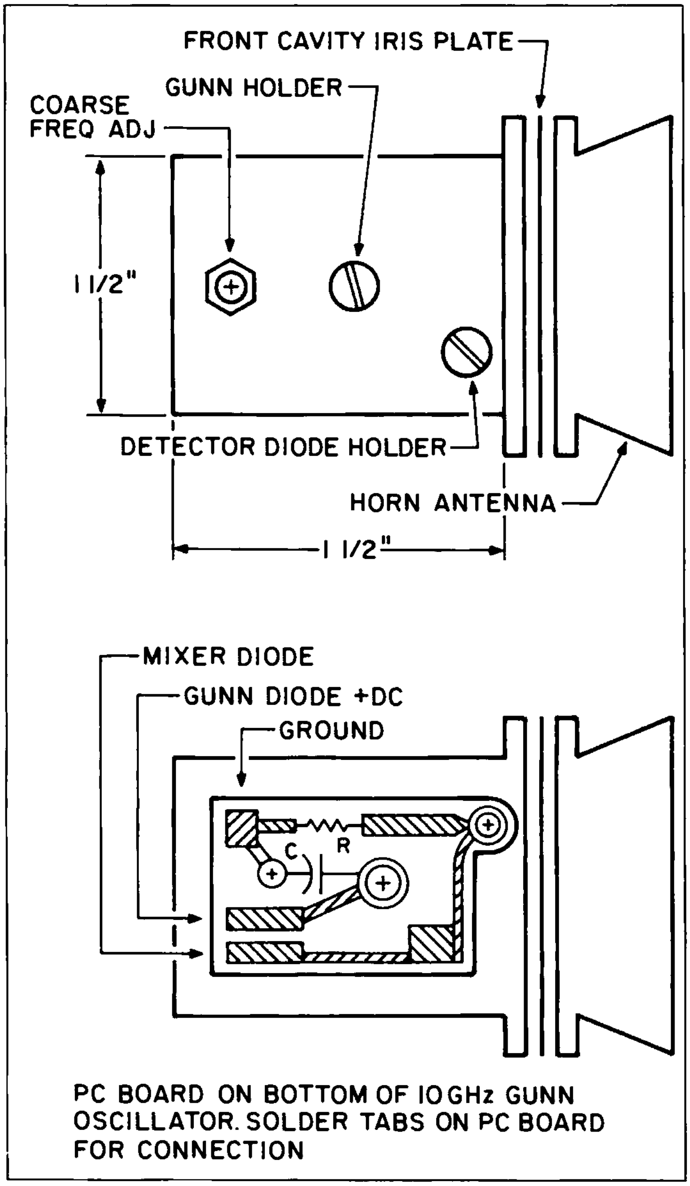

Figure 2. Gunn detector/oscillator for 10 GHz. Samples are available from Emcomm Inc., 10 Howard St. Buffalo NY 14206; (716) 852-3711; cost: $50 each new.

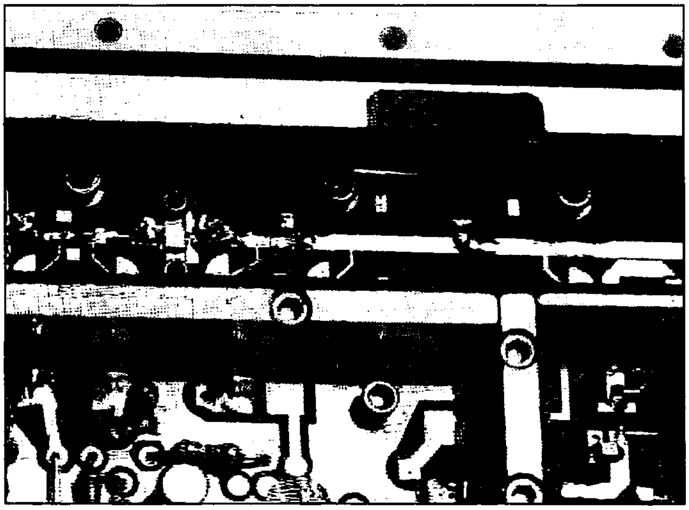
Photo D. Close-up photo of the driver output, final amp modifications.

Low Power Operation

Michael Bryce WB8VGE
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Massillon OH 44646

Measuring RF Power

It seems fitting this month to talk about measuring RF power after discussing what a "QRP" is. Just about every QRPer I've ever known has his or her own way of measuring the output of a transmitter. I've used just about every known way myself, and never really found one I think is the best way.

Way back when, some of us hams used RF ammeters in the feedline to indicate maximum RF current. This usually occurs when the feedline is matched to the antenna feedpoint. The RF ammeters are kind of useless at QRP power levels.

One method I use on the testbench to measure RF when designing a transmitter is to read the RF voltage across a resistor. This requires an RF probe and a VTVM or other high impedance meter. I use the 50 ohm resistor in my Cantenna dummy load when using an RF probe. Here's how you do it: Place the RF probe across the dummy load. Apply power and key down the transmitter into the dummy load. Read the resultant voltage on the meter. Now, calculate the power by means of P (watts) = E (rms)^2 divided by 50 ohms. This works, provided you have a good RF probe and are willing to do the extra work. It's not the method of choice if you're in the mood to check your RF power in the middle of nowhere.

An easier way to get a ballpark figure is to simply measure the input power to the transmitter. This is simple, requires only an ammeter and some simple math. It's not easy to tell if the total amount of current you're reading on the meter is really going to the transmitter. There are buffer stages, oscillators, sidetone generators and other circuits that all require current when the transmitter goes online. If you can cut the VCC line on just the PA transistor, insert an ammeter, then measure the current, you'll get a much more accurate reading of INPUT power. Since power equals current times voltage, it's a simple matter to multiply the two together to find the input power to the transmitter. For instance, if your transmitter is running from a 12.5 volt supply, and is drawing 400 mA, then the input power to the transmitter is 5 watts. Now, the problem here is we really don't know what the OUTPUT power is.

The Bruene Circuit

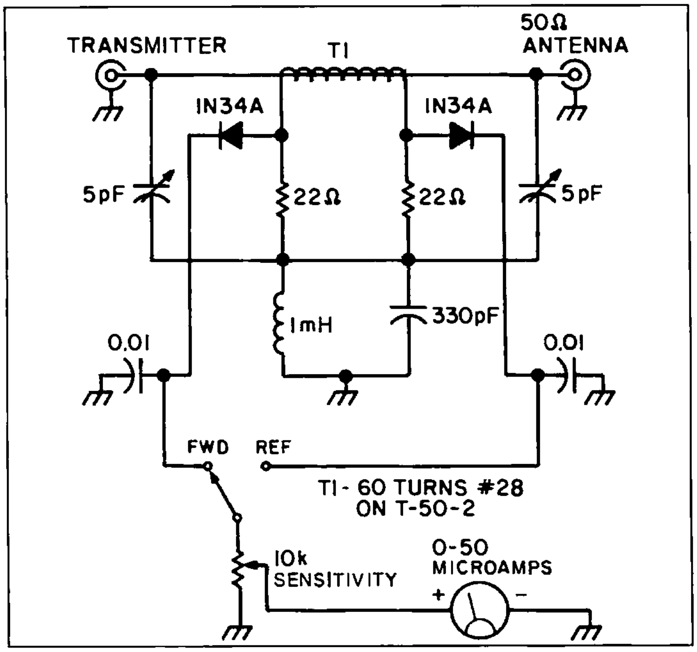

Figure 1. The Bruene circuit.

As a rule of thumb, figure about 50 to 60 percent transmitter efficiency. Monitoring transmitter current can sometimes be a pain in the neck too. Sometimes placing the ammeter in series with the transmitter is either too much trouble or results in a voltage drop across the amp meter itself. The voltage drop may cause the transmitter to put all kinds of critters on the air.

What we need then is an RF wattmeter which will give us a good accurate reading in the 0 to 5 watt range. A classic circuit by Warren Bruene of Collins Radio is shown in Figure 1. There have been many variations of this circuit over the past years. It's still a good performer and you'll see it used commercially in today's transceivers.

In a nutshell, here's how the Bruene circuit works. A toroidal transformer samples the 50 ohm RF line and causes RF current to flow through the secondary winding. Think of this as a simple transformer with the primary side being powered by the RF from the transmitter. On the secondary, two diodes convert the RF into DC to be read by the meter. One diode will read the forward voltage produced and the second diode will read the reflected voltage. This way, the Bruene circuit makes a very good SWR meter.

The Bruene meter circuit needs to be balanced and this is the reason for the two small value trimmer capacitors. Depending on the sensitivity of the meter used, RF power levels under 500 milliwatts will provide full-scale deflection.

Now, the only problem with this sort of metering circuit is in the construction. It should be built on a single-sided PC board and the parts layout needs particular attention. Also, a metal box is a must. This circuit won't behave itself if you put it in a plastic box. You can use some double-sided PC board stock to make an RF-tight box, then put this into a plastic box if required. If you're sloppy in the construction, you won't be able to null out the meter.

Up to a point, the Bruene meter circuit is frequency sensitive. A watt of RF at 3.5 MHz may not be the same amount of power needed to produce the same meter reading on 30 MHz. When building this circuit, calibrate it for the highest band you plan on operating.

Calibration requires either using another wattmeter of known accuracy, or digging out the RF probe and the VTVM. I use the first method and find it works quite nicely.

I've built several versions of the Bruene meter. Most have worked just fine, some were real dogs. There is one thing I did do to change the way it operates and that was to do away with the calibration pot. Now, you'll need this pot when you're doing SWR checks, but for measuring power, I've never been able to reset the calibration pot to exactly the same place every time. I never knew if I had the pot set right and thus was never sure of the reading I was taking.

I fixed this problem by adding a rotary switch to select up to four different trimmer pots. I had one position set for 0 to 1 watt, a second for 0 to 2 watts and the third for 0 to 5 watts. The fourth position gave me the calibration pot for setting SWR sensitivity. I also used this position in the forward reading position for very low RF levels. I found I could sense RF under 100 mW if my basic meter movement sensitivity was 50 micro amps. By using the three positions, I was able to keep the reading on the higher end of the meter's scale, where its internal accuracy is at its best. If one wanted to, a small one-transistor amplifier or a 741 op amp could be used as a DC voltage amplifier to allow use of the common 0-1 mA meter movements. Take it from me, the idea is good, but you'll need a battery to operate the amp. Without fail, the battery will be dead when you need it most.

Next month, I'll show you how to build a directional wattmeter. It's an easy project. A kit is available for those of you who don't want to spend a summer looking for parts.

HAM HELP

Number 27 on your Feedback card

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly double spaced, on a full (8 1.2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: Wayne's *excellent* old *Hot CoCo* magazines for my old Tandy Color Computers, and software for same. Also, how can I use the CoCo as a packet TNC? *Charles Scanlon KA1UVE, 2 Eagle Lane, Simsbury CT 06070. Tel. (203) 657-8373.*

Needed: Any data, manual, schematic, updated rolls for a Jackson Model No. 648 Dynamic Tube Tester. Does anyone know if there is a successor to Jackson Electric Instrument Co. of Dayton OH? I will pay for copies of above items. *Don Jenkins WA6OGH, 5045 Donna, Tarzana CA 91356. Tel. (818) 342-3917; FAX (818) 345-8192.*

Needed: Schematic for "St. Clair" VTVM. No model number or serial number on the case. The Model number on the meter movement is #451—St. Clair Engineering Co., Benton Harbor MI. Meter Ranges: 3v, 10v, 30v, 100v, 300v, 1000v. Ohm Ranges: RX1, RX10, RX100, RX1000, RX10,000 and RX1 Meg. Circuit Selector: Off, -volts, +volts, AC volts and ohms. Tubes: 6X5, 6H6 and 6SN7. I will pay for copy. *Bergen Wilson, 1403 Lyttleton St., Camden SC 29020.* Thanks.

I am looking for the complete latest mailing address of a manufacturer of TRICK brand sheet-metal bending machines. Any *73* readers with this info please write to me. *Benjamin Tan, UNITED MARKETING, Isabela, Basilan Province, 7300 PHILIPPINES.* Thanks

I need operations/maintenance manuals for the following: Radio Receiver R-390A/URR manufactured by Collins Radio; Hewlett Packard Model 608D VHF Signal Generator; Textronix Type 545A Oscilloscope; Test Set Electron Tube, TV-7/U; Audio Oscillator TS-382 D/U. I will pay reasonable copying and mailing costs. Please write or call before shipping manuals. *Larry Keith KF8BX, 418 Heritage Drive, Warner Robbins GA 31093. Tel. (912) 329-0030.*

Wanted: Young hams (18 and under) wishing to start a club. Please write to *David Kukier N8UDP, 620 W. Lewiston, Ferndale MI 48220.*

Wanted: A copy of the manual for Heathkit Ignition Analyzer IO-20. I will pay copy cost and shipping. Ship to: *Ed Nell WB2OEB, 103 Bar Harbor Rd., Freehold NJ 07728. Tel. (908) 462-8918 eves.*

Needed: Schematics for Montgomery Ward scanners made by Bearcat. Model numbers are GED-836A and 835. Clear copies are fine. *Bob Flesch W3IEZ, 7500 E. Pocono Dr., Iverness FL 32650.*

73 INTERNATIONAL

Number 28 on your Feedback card

Amie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

As I am writing this, one of hamdom's annual events is taking place: Field Day in the United States. I usually chat about it in my column because it's one of those events that ALL can take part in and have a good time. Whether you are interested in HF or VHF/UHF contesting, satellite contacts, packet, home-brewing antennas, etc., Field Day has something for everyone, even camping out and cooking.

One thing I have found out in the past is that there has to be at least one contact person to turn chaos into order. Those of us in the Keene, New Hampshire, area were very lucky to have Doug KD1GJ volunteer to coordinate our efforts. Of course there were many others who got involved but won't be mentioned in print here due to lack of space.

Location is another important factor. This effort look place in Wheelock Park, one of the many parks in Keene. We were able to operate, as well as be spectators at many softball games, some that went late into the evening. We even had some of the spectators of the games coming over to our location and watching what we were doing.

We operated 2A (primarily on 40 and 80 meters) with one HF rig hooked to a delta loop antenna hung from one of the tall pine trees surrounding our position. The other HF rig used a five-band vertical antenna positioned in the outfield, behind second base, on an unused softball field. Both rigs and computers, used for logging, were supplied with AC power from a generator which ran very nicely for 24 hours, without ever being shut down.

The last position contained the satellite operation, powered by a battery which had been charged by a solar cell for many days before Field Day. I think putting the antennas together for the satellite operation brought us the most spectators during the setup.

One thing that I will always remember about Field Day happened several years ago while I was on vacation in Gunnison, Colorado. I was able to operate with some hams there, contacting several stations back here with operators I knew personally. Well, this year I didn't make it to Colorado but I did the next best thing: I was able to contact WØGYV, the group in Gunnison, on 15 meters. The fun thing about it was that I was mobile at the time with my trusty Atlas 21ØX, on my way home for some sleep.

I guess the central theme of my comments in this column, as well as many of my other columns, is that this is a very small world indeed. We are able to make lasting friendships, sometimes without ever meeting the other person. But, many times we gel lucky and meet some fantastic people who become our friends for life.

What am I trying to say? Make the best of everything now, cultivate new friendships, and enjoy life to its fullest!—Arnie, N1BAC.

Roundup

Bulgaria *From Milen Postadshieff LZ2MP:* Just a reminder that the LZ DX Contest will take place on the first Sunday in September from 0000 to 2400 UTC, 3510-3560, 7000-7040, 14000-14060, 21000-21080, 28000-28100 kHz, CW only. Send logs for each band with a summary sheet not later than 30 days after the contest to Central Radio Club, PO Box 830, Sofia 1000, Bulgaria.

Japan *From a letter from Frank L. Striegl 7J1AAL/KA2TNZ, President of TIARA:* In 1972, a lew foreign hams organized TIARA, the Tokyo International Amateur Radio Association. At that time, the world was a different place. Japan did not command the attention and interest that it does now. Most people outside Japan did not know about sushi and sumo, and Japanese amateur radio equipment was coming into greater use. Amateur radio operation for foreign hams in Japan was also different. Those were the days before reciprocity, when all non-Japanese hams who wished lo operate in Japan had only two options: operate a Japanese club station, or pass the Japanese language amateur license examinations.

The founding members could not have foreseen the immense changes that would occur in Japan, nor could they have guessed that TIARA would grow into a major organization with about 100 members.

In the mid-1980s, TIARA club officers were instrumental in facilitating reciprocity agreement negotiations between Japan and the U.S., and now such agreements exist between Japan and the United Slates, Canada, France, Germany, and Australia. Foreign hams coming to Japan can obtain information from TIARA on operating in Japan and assistance in setting up. Several TIARA members are VEs, and they hold frequent testing sessions for hams who wish lo obtain or upgrade U.S. licenses. *[That's great!!!-Arnie]* In addition to serving the needs of foreign hams in Japan, we work to further comradeship and cooperation between Japanese and foreign hams. The Japan Amateur Radio League (JARL) and TIARA have built a cooperative relationship, and under the sponsorship of JARL, TIARA participates in the annual hamfest at the Tokyo Harumi Fairgrounds.

Japan is complex. II has the largest Asian-language-speaking amateur radio community in the world, with over one million licensed hams. Many of Japan's hams are highly advanced, with sophisticated equipment and lechnical knowledge. TIARA must function as both a bridge and an outpost; this is a real challenge! Many of our foreign members cannot function in Japanese. High member turnover occurs since many members are here lor a short time. We have a few retired members with extensive free time to dedicate to the club. Also, unfortunately, we tend to be isolated from support from ham communities and associations in our home countries.

So congratulations are due lo all members of TIARA, past and present, foreign and Japanese. It is their efforts that have bulll and sustained TIARA. We hope that during the next 20 years TIARA will conlinue to be of service to its members, and to the worldwide amateur community . . . de Ron Fenne, 7J1ABE/NA3G.

Weddings are always happy events, but even more so when both bride and groom are hams! Photo A shows the wedding reception of former TIARA Vice-President Keishi Kishomoto JF1BNR, Billett DU1BE, and some of the many invited guests. All but one of the people in the photo are hamsl The only non-ham is the XYL (in kimono) of the person taking the photo, JA1SQD. Several of the speeches given during the reception mentioned Keishi's deep interest in ham radio, and how it came to be a key factor in bringing him together with Billette. *[Frank L. Striegl 7J1AAL, 4-39-7-503 Kaminoge, Setagaya-ku, Tokyo 158, Japan]*

Scotland *From John "Paddy" McGill GM3MTH:* The Scottish Tourist Board (Radio Amateur) Expedition Group events for September are: GB2NTS at Culzean Castle, Maybole, Ayrshire, and the 4th Annual 8 Nations National Trust Event with 10 stations operating in the UK and Ireland from National Trusl Properties on September 19-20. Some of these stations besides GB2NTS are GB2NTU, EI7M/P, EI4DCD, GB2NTW, GB2NTC, GB2NTE, GJ3DVC, and GT3FLH. More information is available from Paddy at 9, Ramsay Place, Coatbridge, Lanarkshire, Scotland, ML5 5RE. The next scheduled event is November 30.

Switzerland *From the International Telecommunication Union (ITU) Press:* The instrument of accession of the Govemment ol the Republic of Croatia was deposited with the ITU on 3 June 1992, making this country the 169th member ol the Union.

Croatia is bounded on the north by Slovenia and Hungary, on the east by Serbia, and on the west by the Adriatic Sea. It covers an area of about 56,500 square kilometers, with a population of approximately 4,764,000 (1991). Its capital is Zagreb.

Photo A. The wedding picture of Keishi Kishimoto JF1BNR and Billette DU1BE.

AUSTRALIA

David Horsfall VK2KFU
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Australia
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Following further development of amateur radio in Australia, the regulations are about to be significantly overhauled, and the "Code-less Novice" is about to become a reality. Details are sketchy at the moment, but it looks like Novices will gain a part of the

Photo B. New URL clubhouse, visitors, and antennas.

70cm band, as well as their current 2m FM privileges, with HF an option.

It is not known whether they will gain a special suffix (there are not a lot of suffix blocks left) or whether callsigns will be issued from the current Novice blocks. There was talk of a special prefix (as distinct from VK), but personally I see no need to distinguish code-less Novices from their CW-qualified brethren.

Packet radio does not appear to be included, but there is pressure to do so. If Novices are permitted to use packet radio (with no CW qualification, hence no access to HF) this will be one of the most significant developments in amateur radio in this country. Packet radio needs an influx of technically-inclined people, usually the same ones who see little relevance in Morse code, and the Novice license is particularly attractive to young people. Let's hope that Novices will be allowed to "trade" CW tor packet!

Full details will be available soon and I will summarize the changes next time.

BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena, 49/701
20270-240 Rio de Janeiro
Brazil

Radio Amateur in RIO-92 Ecology Summit

A few months ago, before the International Ecology Summit for Environment and Development took place in Rio, the Federal University of Mato Grosso do Sul, in the southwestern part of Brazil, got in touch with our LABRE RJ (Rio de Janeiro branch) and Paulo PT9PDS, Director of Mato Grosso do Sul's LABRE MS, and started initiatives so that three or four students of journalism could come to Rio and have official facilities for their stay here.

The day finally came for the three or four students to arrive to cover the most important conference in the world, the Rio Ecology Summit. You know students and journalists, don't you? Or do you?

The three or four expected visitors were, In fact, a noisy group of 25 young girls and boys, all excited by the feverish opportunity of such an experience, their first real contact with responsible journalism!

One by one, all promises for sheltering and nourishing the now 25, instead of the announced three or four, FAILED! And what was left was the bitter reality of a question, WHAT DO WE DO NOW?

The Army's Copacabana Fortress Command offered a "camping solution" using military emergency barracks and a "camping site" inside the fortress. Not bad at all! After all, the students would get safety and Copacabana Beach! After two days of a meager diet, food was guaranteed by the Rector of another university.

The last problem to solve was where the students' headquarters for operation would be. The LABRE RJ opened its doors for them for as long as necessary, and this meant 15 days of wonderful familiarity, boys and girls shuttling to RIO-92 and having their articles sent by packet radio and HF radio twice a day, by at least 1000 and 1500 UTC, and receiving news back from their far distant relatives and loved ones.

The BRA-NET was a Packet Radio Program in Portuguese for BRAZIL, and in English for DX, with Paulo PU1JUD and Edson PU1JTE as editors. LABRE RJ was happy to show one more way radio amateurs can help people, no matter what the subject, In our society.

After 15 days use of LABRE RJ's headquarters, when the Ecology Summit RIOO-92 was over, the students moved back to Mato Grosso do Sul University knowing more about radio amateurs, this almost unknown fantastic helping tool for the development of nations.

LABRE RJ offered them a final farewell cocktail, and this sure was a happy ending to an unusual adventure, joining with university youth, to plant the seeds of our hobby in the wonderful soil of one of our high-class universities.

73 de Cart, PY1CC

CANARY ISLANDS SPAIN

Woodson Gannaway EA8/N5KVB
Apartado 11
35450 Sta Madre Guia (G.C.)
Islas Canarias
Spain

This spring saw the official dedication of what is almost certainly the most beautiful clubhouse in the world. In an earlier report I mentioned that the URL was busily enlarging and remodeling their "shack" in Las Palmas (de G.C.). They took an already nice clubhouse and completely redid it, complete with a second story and new antennas.

Richard Baldwin W1RU and his wife Phyllis came from mainland Spain to participate. As the IARU conference was in session and Richard is the head, they were relatively close. Richard commented that the idea of the clubhouse for the whole family was a Latin phenomenon and that this was by far the nicest one he had seen in his travels. Alfonso and all the club members are justly proud of it.

Although the clubhouse auditorium is ample, it was filled to overflowing for the official dedication. As usual the top government officials attended and participated. As you know, the King of Spain is a ham, and early plans included the possibility of his honoring us with his presence. The skiing accident he suffered ruled out this possibility, but he did honor the club with a personal radio contact during the festivities. The HF radio room was jampacked during that contact but I heard a little from the hall. Afterwards there was a lunch at a nearby restaurant and Canary folk music. Unfortunately I had to leave to attend another meeting but I have no doubt that it was a memorable afternoon. It included fireworks—I saw and heard them from the bus as I went down the hill towards town.

73, Woodson, EA8/N5KVB

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel
Packet: 4X1MK @ 4X4SV.ISR.EU

UFOs in Eilat

Meir 4X4JP recounted in a regular report from Eilat, Israel's southernmost point, that an unknown amateur who apparently arrived in Eilat got on the local calling frequency 145.55 and called CQ CO CO for a week. Meir was overjoyed at the increase in Eilat's amateur population (there are only two hams residing in Eilat), but answering the caller produced no contact. Then Meir thought that the ham might be listening "reverse" and called him 600 kHz down, but still no reply. On and on went the calls CQ CQ CQ from U5MIR, with no regard to Meir's replies. In his report to the *HaGAL*'s editor (the IARC magazine) 4X6LM, Meir thought that perhaps Shlomo knew who U5MIR was. Indeed Shlomo did know, just having finished editing a special issue devoted to satellite communications. U5MIR was, of course, Sergei Krikalov "stranded" on the Russian *Mir* space station orbiting the earth. Sergei has since returned safely to the earth. Meir's signal was probably lost in the QRM when Sergei came into Israel's skies, calling CO.

Mark Stern 4Z4KX completed a successful QSO with Sergei in Russian, having been briefed on the procedures by Shlomo who has over the past several years exchanged packet and voice communications with *Mir*. The trick, says Mark, is to listen on 143.625 MHz when *Mir* is over your skies. If you hear Russian communication, then *Mir* is in contact with one of its official ground stations, and they are not listening to the ham band. However, if the frequency is silent, then jump to 145.55 and give them a call on voice or packet.

For about three minutes Mark chatted with Sergei, who told him that they had just finished dinner up there, and passed greetings to the Israeli amateurs listening, as he is always happy to make contact with our country. Then Shlomo (who Mark calls a "veteran astronaut") came into the QSO to pass on his greetings.

OD5NG Bites the Bullet!

For many years hams operating the digital modes (RTTY, AMTOR, and packet) have seen the call of "Tom" OD5NG pop up. His bulletins, *The*

OD5NG Hit List, were world re-knowned, and through his U.S.A. QSL manager he "confirmed" Lebanon for many DX chasers. He was also no stranger to Israeli hams, exchanging HF digital contacts with them, and corresponding with us in the 4X VHF Packet Net via a HF gateway in Greece. Many may recall "Mike" OD5MA from Nabitiyye in southern Lebanon who contacted us on 2 meters FM, and was even a guest of the Tel-Aviv hams. However, Mike later disappeared, and it was feared indeed from the face of the earth, as was sadly the case with so many in his war-torn land. However, "Tom" OD5NG kept on going from his QTH that he gave as Rashaiyye, also in southern Lebanon, and had no fear of continued contacts with 4X-land. A while ago it became clear as to why "Tom" had been operating from the safest place in Lebanon—mainly in Israel. The following is an excerpt from a bulletin issued by Jim 4X1RU: "Thomas 'Tom' Graham, who was known to use the callsign OD5NG, was forced to curtail his clandestine operations from a small village located in the northern part of Israel. During the first part of February, the Israel Ministry of Communications raided his station and confiscated all of his equipment . . . He had acquired various awards as if he were the single entry from Lebanon, and had worked many stations giving them 'credit' for working Lebanon on RTTY, AMTOR, and packet . . ."

Photo C. Officials at the dedication of the new clubhouse for the URL.

According to Corinne 4X6VT, "Tom" was an elderly man, and he and his wife were packed up to leave Israel, where they had been living for several years, to go back to his home in South Africa. He was taken into police custody for a few days for questioning, but was released and allowed to leave the country on the date he had planned to. At any rate, we in the world amateur community had "the wool pulled over our eyes" for many years by this pirate, who had never held a ham license. To quote the immortal Kurt Vonnegut, "So it goes."

Saving The Ozone Layer

Translated from the April issue of HAGAL, *the Israel Amateur Radio Club Journal:*

Attention Beam Antenna Owners

According to an announcement from the Ministry of the Environment and the Ministry of Communications, beginning April 1st it will be forbidden to use beam antennas for the high frequency bands. This is due to an international decision by the United Nations dealing with the quality of the environment and aimed to prevent the expansion of the hole in the ozone layer. The official notice from the Ministry of the Environment reached the Israel Amateur Radio Club, along with an interesting offer in which beam antenna owners will be able to receive a vertical antenna in exchange for their beam and a nominal fee. Amateurs interested in receiving an alternate antenna are requested to apply no later than the first of April to the IARC membership Services. *[WOW! I wonder just how many really did report to the IARC on APRIL 1st to make the exchange. Ron, could you find out for us, please?—Arnie]*

Never Say Die

Continued from page 4

mosexuals do brainlessly dumb things—I count a lawsuit of amateurs against amateurs as totally unforgivable—but then to start calling names when someone objects to their poisoning the amateur radio hobby with their paranoia almost gets me into writing something libelous. No, I'm not mad, just disgusted.

Unless Lambda retracts their lawsuit against the League, repays any expenses they've caused us members, and issues a blanket apology for libeling me, I will put them in my book, as a group, along with K1MAN and KV4FZ as embarrassments to the hobby.

Most of our worst villains are gone. W2OY, W2KR, W1BUD, and W2BIB come immediately to mind. There's a few more that have dropped out of sight, thank heavens. We don't need sewers in amateur radio.

Even Easier Newsletters

When the first practical laptop computer came out in early 1983, I rushed to the nearest Radio Shack and bought one—the first day they were available. That was the trusty old Model 100. It was so useful that I gave some away as gifts, so that others could enjoy the freedom it provided to write just about anywhere.

I've always felt that I had a good deal to do with the conception of the 100. Back in the very early days of microcomputers a Japanese ham, K. Nishi, used to visit me and talk computers and ham radio. I'd already been the first publisher of *Byte* and was publishing *Microcomputing* and *73* at the time. I'd been publishing rafts of computer oriented articles in *73* in an "I/O" section. Nishi shared my enthusiasm for these new computers, so he started an *I/O* magazine in Japan.

On a trip to the US for a computer show Nishi brought me the first LCD calculator I'd seen. It had been released the previous day in Tokyo by Sharp. One look and I saw the future—microcomputers the size of a book, with the screen built into the lid. I described my vision to Nishi—a book-sized computer, complete with an LCD screen, a built-in word processor, BASIC, a modem, and connectors to the telephone line, cassette and disk drives, and a networking bus.

Nishi went to Radio Shack and interested them in the project. Then he went to Kyocera and got them to design the computer itself. He was working with Microsoft at the time, so they did the software development. The result was my dream of a truly portable computer which could be used in one's lap.

The design was a hit. Kyocera made an almost identical unit for NEC, their 8200, and one for Olivetti for European distribution. NEC went Radio Shack a little better by making their unit so more memory could be plugged into one side, greatly expanding its usefulness. They also came out with a cute (and inexpensive) little printer—fit in a jacket pocket. Radio Shack never seemed to really have much faith in their 100. It was pretty much left to third party firms to supply accessories for it. They did come out with a tiny disk drive—which went with me everywhere, so I could save my work to disk and free up the computer for more work. Added memory modules came from Portable Computing in Seattle, giving me three or four 32K memory banks.

My trusty 100 was in daily use for nine years, going everywhere with me. Oh, I realized that the screen was limiting—only 40 characters across, but it sure was easy to read compared to anything else I could find. Sure, I got carried away by DAK ads now and then and invested in a newer laptop, but after a few days I found myself back using the 100 again.

I set up a simple letterhead in the 100, making it dirt simple to answer my mail. I had no need for a secretary, I did all my own correspondence. A letter doesn't take much longer to type than to dictate, and since I work weird hours—and anywhere I happen to be—this was the perfect answer for me. I'm not into power and prestige, so the home-made letterhead approach reflected my personality perfectly.

Some people collect prestige things. Most of the people who get listed on commissions and committees seem to be in it mostly for the prestige involved. Somehow, when I get on a committee, I soon find that I'm doing all the work. The next thing you know I'm the president. I joined the Peterborough (NH) Chamber of Commerce because I was concerned that the town had no long-range planning. I'd seen what a mess this could lead to with the growth of Nashua and Milford and didn't want that to happen to Our Town (as Peterborough is known). Sure enough, after a couple of years I found myself the president.

I didn't have a lot of success in organizing long-range planning for the town, but I did manage to put a cork on the building of new homes, and I made the Chamber meetings interesting, building the attendance from around 10 to over a hundred.

Now, getting back to laptop computers, my wife is a Macintosh fan. She does her artwork, advertising, newsletters and promotion of her how-to-dance videos (Butterfly Video) all on her Mac. When they brought out their "portable" a couple years ago she bought one immediately. Yes, it's portable, but it's so heavy I had to do most of the carrying for her on our trips.

Then, this year, when Apple announced their new laptop PowerBooks, she immediately put in an order for the top of the line, the 170. She's so into the Macs that she went to San Francisco for a Mac show, where she won a PowerBook 100 in one of those business card drawings. She didn't need two of 'em, so I tried out the 100 and quickly discovered that my old Radio Shack 100 had been replaced.

The Mac 100 is easy to read and moderately easy to use. The old Model 100 was so simple that anyone could master it in 10 minutes. Well, almost anyone. The Mac 100, supported by several inch-thick manuals, is going to take me a long time to really master. But old Never Say Die will prevail. If six-year-old kids can do it, then dammit, so can I.

To give you an idea of the power of this contraption, I've just finished writing a little treatise on repairing our stupid 19th century model educational system. I wrote the whole works on the 100. I then formatted the material in the type of my choice and watched my printer turn out a 44-page book, all ready for printing. I did up a dozen preliminary copies with a photo copier—eleven 11" x 17" pages.

Hey, this is fun! I next did a paper on how to fix the lousy mess in Washington. How to make Congress honest. How to solve the deficit. How to handle the inner-city riots. How to cut down on the bureaucracy and get our civil "servants" into honest work. That printed out in 20 more pages.

I'll redo these pages and add them to my earlier Report to the NH Economic Development Commission. That should bring the whole report to about 380 or so pages. But I just couldn't get over how easy it was to write and get pages ready for printing. This is the answer for small businesses. This is the answer for clubs. This little laptop computer has enormous power. It comes with two meg of RAM memory, but can be expanded to six meg. It has a built-in 20 meg hard drive—expandable to 120 meg. If I keep writing books like this I'm going to need 120 meg. In truth, the 44-pager took under 300K of memory. Yet, unlike my old Model 100, I was able to keep this all in one document, and not have to break it up into 32K segments.

The computer automatically numbers the pages. As I get better at using it I'll be able to integrate artwork and photos. I'm not sure what the street price is for the Mac 100, but I'll bet you can get one for well under $1,000.

If you have anyone in your radio club who knows how to write, urge 'em to get a Mac 100 and get cracking on a club newsletter. It's easy and fun—and it'll help attract more members and get everyone more involved with the club activities. Has anyone ever seen a strong ham club without a newsletter?

If I wasn't so busy with my own work I'd be out looking for contract work to do. I know some people who are doing this with considerable success—all based on doing desktop publishing with the Mac. They're doing newsletters, books, promotions and so on.

A few years ago the ex-wife of an old ham friend of mine bought what was then the state-of-the-art in computer typesetters. She set it up in her New York apartment closet and started writing books—mostly on contract. She did very well at it, but the investment at that time was substantial for the equipment—and a good deal of paste-up was still needed.

Now, for under a twentieth of what it cost her, you can get a Mac PowerBook, an Apple LaserWriter printer, and that's all you need. You do the typesetting, layout and paste-up all on the little laptop computer. Then you plug in the printer and minutes later you've got a book.

Ooops, you find a typo on page 27! Big deal. You go to page 27, make the correction, and print a new page 27. If you decide to add a chapter or paragraph, the whole document automatically repaginates for you. You can even call a miniature version of the pages to your screen and see how they look, two at a time.

By the way, if you can't wait for me to get my book out on how to get America going again, you can get a dump from the *73* BBS. It's a 300+ page book, so this is going to take some time.

Millions of New Hams!

Old-timers will go ballistic over the whole idea of opening up amateur radio to not just a few hundred kids, as we've done lately, but to millions. Lordy, it'll be worse than CB! Well, maybe—if we manage to recruit millions of Southern truck driver kids. Now look here you old turkeys, we have some 95% of our allotted frequencies going begging for activity. No, I just counted it all up and we're actually using far less than one percent of our allotted frequencies for which ham gear is readily available or can be simply built.

Sure, if everyone wants to pile up on a few channels on 20m phone, it's a mess. But way down in the lower reaches of the band it's almost wide open, with a few computer-wielding adventurers going at high speed CW with only their exciters and dipoles or even verticals, working all kinds of DX. QRM? Har-de-har.

Look, you old buzzards, stop your lousy whining and griping and take some interest in something other than yourself. Your country is hurting. Millions of people are in poverty. Millions more are out of work. Well, we now have a darned good idea of why all this has happened—and we know what to do to keep it from continuing. When I say "we" know, I mean that I do, and if you've been reading my editorials, you also have a good idea of what's gone wrong. And it's got almost nothing whatever to do with all that garbage the politicians have been serving up. We don't need to pour more money into the ghettos and expand welfare, we need to attack the whole problem at its roots—and that's where amateur radio will fit in.

Yes, I hear you old bustards (that's a bird, not a misspelling), and you're not always agreeing with me. Sure, if you did agree with me you'd be right and you'd be making some use of your lives outside of filling 75m with

puerile prattle. You'd be elmering newcomers instead of trying your best to make their lives miserable. In case you don't know it, the no-code newcomers are the best thing that's hit amateur radio in 30 years. They're active. They're enthusiastic. They're actually *doing* things. And, they're buying equipment like there's no tomorrow, according to our advertisers in *Radio Fun*. This buying splurge is just in time to help the sagging Japanese economy, which has been in a tail spin recently.

As I've been doing my research for my reports to the New Hampshire Economic Development Commission, I've run into some absolutely amazing things. Suddenly, the other day, the pieces fit together and I could see what's happened—where things have gone so terribly wrong. As I explained in my July editorial, we need to add reschool education to our day-care centers so kids will build the brain networks it takes to read and work on long-term projects. I've proposed a total change in our whole educational system which will not just help America get out of last place in the developed world, but will put us firmly in first place.

As you would know, if you read much, America spends more on education and ends up with stupider kids than just about any developed country. We're also spending far more on health care and getting distressingly poorer results.

If we're able to break this losing streak by changing our educational system along the lines I'm proposing, we'll at least have kids who *can* learn and who are eager to learn. If we institute the eight-year course in the fundamentals (notice that word starts with the key—fun) of electronics, communications and computers, we'll get millions of kids interested in hamming. I can hardly wait to hear what you old curmudgeons will have to say when our bands start filling up with 8-year-old kids, all talking about the latest digital processing kits they've assembled and how to modify them—and how they're setting up a digital communications network on 10 GHz and bringing out nodes on 2m. It's tough enough trying to deal with 8-year-olds, but when they know far more about technology than you, what then? The historic ham response to that problem has been to exclude the kids from our nets and spend our time bad-mouthing them. Damned wise-assed space cadets.

When I was a kid I used to listen to the old-timer nets on 75m, with most of 'em sporting two-letter calls, and hear 'em ignoring any youngsters who dared to break into their QSOs. W1ZE, Irving Vermillia, on Cape Cod, with his AM kilowatt and loudly ticking alarm clock up next to his mike; W2KR, Mort Kahn, on Long Island; Roland W1ANA, Bill (and Olga) W1IF. Of course that was back before VFOs had been invented and everyone was rock-bound. No kid was dumb enough to buy a crystal for any of the old-timer net frequencies. Crystals were made by Bliley and they cost around $70 in today's dollarettes, so we didn't have more than one or two.

Unless we want to see our country falling even further behind in technology, we've got to radically change our educational system and get kids interested in science and engineering. And that's going to mean the sprouting of thousands of school radio clubs and the invasion of our bands by kids. I only hope I live long enough to see and enjoy it.

These kids, being smarter than we are, will not all try to get on 20m phone at the same time and spend their lives cursing each other; they'll head for our microwave frontiers, where there are wide-open spaces. When I look at today's synthesized rigs and computer technology giving us inexpensive RTTY, high speed CW, packet, and so on—and then I compare that to the crystal-controlled rigs we used to build in the 1930s—I wonder what the ham rig of 2050 can possibly look like. I'll never know. I'm doing all I can to try and hold on and see the year 2000.

Well, we know ICs are going to get smaller. Our HTs will shrink. They'll be multiband. They'll let us call any ham in the world selectively. They'll automatically translate from any language for us. They'll store and forward messages, in case we're busy. Well, all that's within the bounds of our current technologies, so they'll probably come to pass. We'll sure be glad our microwave bands didn't get taken away, as they'll be the work-horse bands in the future.

Millions of kids will bring a whole new life to amateur radio. The old-timers who are spending their declining years venting their frustrations on 75m will soon be gone. I hope someone will make tapes of how things are now and put them away so the hams of 2050 will be able to play them and see how things were just 60 years ago. I know I wish we'd had tape recorders 60 years ago so I could have preserved the ham world of the 1930s.

There's always the posibility that I'll fail in my efforts to get American education changed—that the teacher's unions, civil service unions, bureaucrats and other protectors of the status quo—will win and preserve our costly, badly flawed educational system. In that case we won't have to worry about the kids invading amateur radio.

Want To Make Millions?

If I hadn't already helped a few hundred people make millions, you might just pass my little headline off as more hot air from New Hampshire. Well, maybe. But my record of calling the shots is pretty good—just pick up some issues of *73* from 10, 20 and 30 years ago and see how far off my predictions have been. While tens of thousands of my readers have nodded condescendingly over my editorials, a few have paid attention and hit the jackpot.

Okay, outside of my normal self congratulation, what have I got for you. Well, I got to thinking about this coming digital radio stuff. With up to six separate stations on each channel, they're going to need some system to help listeners know what's playing where and when. No problem. All we need to do is send some sub-sonic signals along with the sound and have an LCD screen at the receiver read out the information.

Heck, we don't even have to wait for digital radio to do this. If I had a workshop and the time I'd see what I could do with sending the digital data via phase shifting the carrier a few hertz. The received information would be stored in a memory chip and displayed on the LCD screen. This could show the station call letters—helpful when you're tuning—and information on what's playing, the performer, composer, and so on. This would be a good medium for program schedules, call-in numbers and even some brief commercials. Of course my favorite would be the record number of what's playing so the listeners could call an 800 number and order the music being played.

Back in the early RTTY days, when we had to make all our own equipment, we made our tuned circuits for 2125 and 2975 Hz out of two coupled speaker output transformers. The circuit was designed by John William W2BFD, who did most of the early RTTY design work. He and I also experimented with the 90 and 150 Hz filters out of the old ARN-7 glide-path receivers. Much to our amazement we were able to get them to work just fine at the standard 60 wpm RTTY speed. This wasn't frequency shift as much as phase shift. With today's chips I'll bet the phase shift could be cut down to a few hertz. You'd never hear it.

Of course with FM the data could be put on a subcarrier so it wouldn't be heard. And with digital radio we'd just use one narrow channel for the data. Well, we could widen it a bit and send fax newsletters as well as program information.

I'd hoped that hams would develop the concept and use it on our ham bands. I'd love to tune 20m and see the call of every station as I tune past. DX stations could even include QSL information. One of these days someone is going to decide to give it a try and probably end up with a business the size of Apple or Microsoft. Once it gets going every radio station in the world will be using it and every radio made will have the readout built in.

The next step is obvious—a small computer built into the receiver to check out the call letters being received and let you know when a new country turns up. Or you could have your receiver look for stations you want to reach. That would be a great accessory for contests, automatically hunting up and down the bands for stations you need to get extra points.

Let's see now, if I come up with the system and license it for a royalty of a buck a radio, I'd make millions. But darn it, I'm retired these days, so I don't have the time. You do it.

The American Holy War

In my book I'm asking all Americans to declare war—a holy war—a fundamentalist war—against socialism. Sure, we beat the heck out of socialism in the USSR and Eastern Europe. We've even beat it in Vietnam, if you read the recent article by P.J. O'Rourke on his visit there in *Rolling Stone*. The one place we haven't beat socialism—the one place it's going the strongest in the world and devastating the country in the process—is right here in America. That's right, here in our US of A.

It was socialism that destroyed Great Britain and it's socialism that is at the heart of what's killing America. How did this pernicious anti-God, anti-life religion get such a powerful hold on the world—and even on America? And how can we fight such a well inculcated religion?

God? Religion? Yep, let me explain. A religion is defined as a belief upheld or pursued with zeal and devotion. Well, that's what we have here.

Getting Fundamental

Religious fundamentalism is causing wars all around the world. Perhaps it's time for us to take a close look at the fundamentals of life and start fighting for them here in America. So let's take a close look at what we've been doing and how it fits in with the most basic laws of nature. Will you be offended if I suggest that the laws of nature are the laws of God?

Okay, what is the most fundamental law for all living things? What is the most basic law of all? It's staying alive, right? Unless we're really screwed up, we'll fight the hardest of all to stay alive. Indeed, this is basic rule number one. This one is built right into the genetic pattern of every living thing. This built-in law also causes us an enormous amount of trouble, it being at the heart of all our mental illnesses and aberrant behavior. That's one of the problems that always crops up when you have a law which is enforced, no matter how unreasonable the enforcement. This is a law which helps to kill us. That's a strange dichotomy and may be difficult to grasp, but it's logical.

If self-preservation is rule one, what's rule two? The preservation of yourself through your offspring. That's why we have love, lust, and all those other great-feeling things we think about, talk about, and sing about. We're talking a very, very basic law of nature. I hope you'll agree that this qualifies as rule two. This is the rule which we feel driving us every day. This has to do with bikinis, deoderant soap, tight jeans and so on. It also leads to the concept of the survival of the fittest, which we might consider as rule three and the result of rules one and two.

The reason even the smallest of boys tend to fight is in preparation for later life when they are going to have

to fight for the choicest girls. It's genetic. Men fight off other men to ensure the survival of their offspring. Women build nests. This survival of the life forms best adapted to winning the battle to propagate has resulted in the survivors we see around us today.

Now let's look at that survival of the fittest concept and think about it. This is where socialism comes in and screws things up. Socialism has as a basic concept the protection of the weak. We see it in welfare payments. We see it in our non-profit institutions. We have hearts. We've been taught to try and go against nature. We see our whole government working on this fundamental basis.

Did democracy win against socialism in Europe? Of course not! It was capitalism that won. Capitalism is the epitome of the survival of the fittest. Socialism is the opposite—to help the weak to survive. Adam Smith's *The Wealth Of Nations*, written around 200 years ago, describes how capitalism works with an "invisible hand." It ties in closely with rule one, self-preservation. It also ties in with rule two, survival of your genes. No wonder capitalism is winning!

Capitalism is winning everywhere it's permitted. Hong Kong and Singapore are capitalist societies and enormously successful. Neither are democratic, by the way. Vietnam is emerging from the chaos of its war at a record pace because capitalism is going strong there. Capitalism is doing pretty well here in America. It's the socialist systems we still have in place that are making us sick.

Just take a look at our biggest social works—our public schools, the post office, the government bureaucracies, welfare, unemployment benefits, social security and so on. There isn't one single thing that the socialist approach can do that the capitalist approach can't do better and cheaper.

Our public schools cost more than double what our private schools do and provide a lousier educational product. We have teacher's unions to help protect the jobs of incompetent teachers who are making a mess of our kids. Every study of the post office has shown that if the service was allowed to go private we'd get far better service at a fraction of the cost. Well, the same thing holds for virtually every government-controlled service we enjoy.

We know what a cesspool the whole welfare system is. Right here in Peterborough we have people on welfare. I've had employees quit so they could go on welfare. They didn't get as much money, but they never had to work again. One of my employees has a friend who does social work. One of her cases is a 22-year-old woman with two kids. She hasn't worked in years. New Hampshire provides her with an apartment: it provides day care for the older child. None of your economy day care, mind you, we're talking $90-a-week day care. Plus the state spends $100 a week to provide taxi service to take the kid to the day care center and drive him back. Plus she gets food stamps.

This woman has no marketable skills, nor is she being encouraged to develop any. She's supposed to be getting advice from a social worker, but she's refused to talk with the worker. No one knows how screwed up her younger baby is getting at the hands of this mother.

I wish this was just an anomaly, but the more you read, the more exposés you see on TV, the more you know that something is fundamentally wrong in America. What was it about not screwing with Mother Nature? Well, we may have hundreds of millions of people who believe in the Koran, and hundreds of millions more who believe in the Bible, and more believing in the Baghavad Gita, and so on, but when I look for the hand of God, I see it in the fundamental rules of life. I see it clearly waving us on with rule one: self-preservation. With rule two: Continue your life through your children. And I see capitalism in harmony with these dynamics and socialism fighting them—fighting God's will. So that's why I'm preaching fundamentalism. I'm not talking worship or spiritualism. I'm not talking mystical belief. I'm not talking churches and ritual. I'm not talking voodoo or reincarnation. I'm talking the rules which we all can see, feel and experience. I'm talking the rules which make sense.

Are there any more self-evident rules? You bet, it's just that they aren't as all-powerful as number one and two. Our love and protection of family comes under number two. But beyond that we feel a kinship for our extended family—our group. We find there are times when belonging to a group definitely helps with self-preservation. I'm not sure this is a genetic rule. It may be a pragmatic one, but it's one we learn even if it isn't genetic. Like the other rules, this one gets us into all sorts of trouble. You can see it going berserk in Yugoslavia, Czechoslovakia, Northern Ireland, India, Sri Lanka, Timor, Ethiopia, Sudan, and so on. It's doing fairly well here in America, helping keep the blacks, whites and Hispanics at odds.

Yes, we do need government. We just don't need anywhere near as much government. Most of what the government is doing—or perhaps trying to do, but failing—could be done for a fraction of the cost and done infinitely better if we could reject the socialist mind set.

What would our government be like if it was run like a business? Suppose inefficient and arrogant workers could be fired as they are in most for-profit businesses? Yes, we'd have to change our educational system so people would have the skills they need to do the work efficiently. Well, if we can get the government to stop forcing us under penalty of law to send our kids to public institutions, we'd have people with the needed skills and the enthusiasm to use them.

We've made teaching such a lousy profession that it's mainly the poorest students who go for it—the people who don't feel qualified to compete in the capitalist world. And who teaches the next generation of teachers? The lowest 20% of the previous generation. It's no wonder we're spending the most of any developed country on education and

getting the worst results. Why, it's almost enough to make a person think.

Is There An Escape?

Sure there is, but it means war. We civilians just barely outnumber the socialists in America. By the time you add up everyone sucking on the public teat—teachers, postal workers, state and federal civil servants, social workers, school administrators, our labor unions, and the military, you can see why we're paying such high taxes and getting so little for it. Nothing is working well. We're up to here in drugs, in crime, prison problems, clogged courts, welfare, homelessness, riots, failed banks, failed loans, unemployment, lousy sewers, air we can see, polluted water, dying oceans, and so on.

Now, are we game to start fighting back? Have we had enough yet? Or is it hopeless and we should just keep our heads down and avoid trouble as best we can? How many of us are "mad as hell" yet?

Yes, I'm preaching revolution. I'm preaching war. No, not with guns and Molotov Cocktails, I'm talking about fighting first at the state level. I'm talking running for the state legislature and changing your state. I'm talking getting people who will bring change to Washington with a mandate to abolish compulsory education. Once they do that and private schools can compete with public schools, we'll see capitalism take over.

Once a private mail service is permitted the US Mule will blow away, just as Parcel Post has been decimated by UPS. Let's privatize everything we can think of. Let's get bids from private companies to run our prisons, car licensing, and so on.

If we can get education out from under the socialist system we won't need government jobs to take care of underachievers.

The best part is that we should be able to cut the costs of government by around 75% and cut our taxes significantly.

The Choir?

Not quite! With hams tending to be introverts, I'm not preaching to the choir this time. But then, I guess I never have. It took me years to get across the concept of no-code—which is still being angrily fought by far too many of you. Now I want you to become activists and help save our country from the ravages of socialism.

Of course I did have some success in getting hams to go for repeaters. Oh, I got a lot of angry letters at first. But then I got them when I pushed SSB in the late '50s. Damned Donald Duck talk. I've never let angry letters stop me.

It looks to me as if capitalism is an idea whose time has come. It's in line with nature. It's in line with God's rules. We're paying the penalty for fighting Mother Nature—and it's a stiff one. It would be *nice if* you could talk up revolution on the air, but I know how difficult it is to break the habits of a lifetime—and in our case that's a habit of never saying anything remotely smacking of thinking over the air. Duuh, the handle here is . . . . and so on. Well, perhaps the RTTY and packet chaps will pick up the flag and run with it. Those are our main refuges for intelligent communications. I hope the RTTYers and packeteers won't be too angry at me for letting that cat out of the bag. They've been depending on secrecy to keep their intelligent communications preserve isolated.

The Solutions

In my editorials over the last few years I've tackled many of the problems besetting America (and much of the world, for that matter). I've proposed some fairly simple solutions to miseries such as our inexcusable education system, drugs, high prison costs, the inner city riots, cleaning up the horrible mess we've let Congress get in, the deficit, our bloated government (both state and federal), eliminating college tuition, cutting education costs by around 30%, and so on. As a member of the New Hampshire Economic Development Commission I did further research on these problems and put that together with my past ideas and presented the whole works as my report to the Commission. Urged on by friends (yes, I have a few), I've put the report into book form which I'll be distributing in New Hampshire.

My solutions may not be the best, but they all seem practical and to do what's needed—and most of them aren't all that difficult to implement. We're in a time when everyone seems stunned by the problems and few people are even thinking in terms of solutions. Well, most of our problems have been solved somewhere in the world before, so it's more a question of finding these solutions and applying them here.

With the exception of Barry Goldwater, no hams have done much in politics, so I'm not sure how much of an action base the readers of *73* will make. We know the problems—we have some practical solutions—now what do we do? The sorry fact is that the fox is guarding the hen house. Trying to convince politicians that capitalism is better than socialism calls for a leap of faith few will be able to manage. We've got several politicians on the Commission and I know how deeply ingrained the whole socialist manifesto is with most of them. Private schools? Oh, my God! Get welfare people interested in working? Oh, I forgot to mention, the New Hampshire welfare people put in cable TV for that 22-year old woman so she'd be able to watch more than just the four major channels during her long, empty days sitting at home. That costs $75 to have installed and I forget how much a month. I hope they're paying extra so she can have the movie channels. And you may be sure that this same outrageous nonsense is going on where you live and that you are paying for it. That comes out of (a) the 25% of your pay you never even see, (b) the other hidden taxes like those on business which make you pay more for products, and (c) the government is borrowing from you to fund the deficit. And that's money

QSL of the Month

To enter your QSL, mail it in an envelope to 73, Wayne Green Inc., 70 Route 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to 73. Entries not in envelopes cannot be accepted.

you'll have to work for years to repay. Are you upset yet? What does it take?

Another person I know well has a sister who worked for the post office for a year and a half and then got a phony letter from a doctor saying that she was suffering from stress. She was put on 2/3rds pay and retired at 22. She's been happily living on this for the last 20 years, getting full postal worker medical and retirement benefits, and with no income taxes.

There are endless examples like this—and these are the people who are going to fight any changes in the system. We're supporting these leeches. We're working hard to support them. We have to make do with old worn-out things—buy a cheaper car or rent an apartment instead of buying a home—send our kids to public school instead of a private school, thereby doing them irreparable harm—all so a welfare mother won't have to learn to type and get a job doing data input. It makes you proud to be an American. It makes you want to re-elect the lousy ba . . . er . . . chaps who've been doing this to you, right?

With both the Democrats and the Republicans talking more taxes and neither one talking change, it's no wonder so many Americans are fed up. And the challengers to the congressional seats aren't promising anything different. Most of them are career politicians and will be the same as the present crew. Any fear of not being re-elected will immobilize them when it comes to making changes which the postal, civil service or educational *unions* oppose.

So, as Pogo said, "We've met the enemy, and the enemy is us." We just don't care enough about having our money taken from us. We don't care about the way they waste it. We don't care that we're being screwed. Oh, I suppose we care—a little—but not enough to take time from hamming, watching ball games or having a beer to actually try and do anything about it.

One thing is certain, we can fight nature for a while, *but eventually nature* will win. The sooner we stop fighting against nature and start fighting for her, the sooner our quality of life as a country will start improving. God has been speaking, but not many have been listening.

Permission is granted to photocopy this editorial and send it to anyone you want to aggravate.

Please advise.

IEEE Screws Up

Alert reader KD5LV sent me a clipping from the June 22nd Electronic Engineering Times with a report that the IEEE has issued a position paper saying, "There is no scientific evidence for the alleged link of police radar with cancer."

Why does this remind me of the tobacco companies and their endless bunch of paid scientists who testified that they could see no link between smoking and cancer? And we saw the same baloney with asbestos. We're also seeing the same stuff with power companies paying scientists to testify that their magnetic fields can't be causing cancer, leukemia in children, miscarriages and so on.

Well, I have a stack of scientific papers about a foot high which back up the danger of magnetic fields and the incidents of cancer in police officers due to their radar units. 60 Minutes recently aired a segment on this. Not that they're always right, but this time they did their homework pretty well.

One of the key research scientists in this field is Ross Adey K6UI, who has given some interesting talks at ham conventions. There are even some videos available—you might try seeing if the ARRL has some for loan to your club.

Shame on the IEEE for this sellout of their members. Oddly enough, the founder of the IRE (now the IEEE) was a good friend of mine. He lived a couple blocks away in Brooklyn and was good friends with my grand parents, so we visited him often. When he died I inherited a huge stack of original patents for early radio devices. I donated them to the IEEE.

We've got enough *problems* with career politicians who will sell any public interest out for campaign funds without our engineering societies buckling under to special interests.

Number 29 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events** in message **Area #11** on our **BBS (603-924-9343)**. for listings that were too late to get into publication.*

ANNOUNCEMENTS

GRENADA, MS The Grenada Lake ARC conducts VE Exams the 2nd Sat. of each month at 9 AM, at the Bank of Mississippi, downtown Grenada, in the upstairs Conference Room. Please use rear entrance. Directions: From I-55 and Miss. 8, go east into town to the second red light (US 51 and Miss. 8). Turn left, go to second light, turn right. The bank will be on the left about 3/4 mile. Talk-in on 146.700 (-600) rptr. You will need to bring a photo ID, your original FCC license, and a photocopy of it; your original CSCEs and photocopy, and the $5.40 fee. FCC 610s will be available. Walk-ins welcome. No Pre-registration necessary. Contact: ***Paul Wood N5UHW, (601) 227-2034; Bill Hunt AB5FI, (601) 227-1047***; or ***Bill Barbee AA5ZR, (601) 226-4014***.

SEPT 6

BURLINGTON, IA The Iowa-Illinois ARC Inc. will host Burlington Hamfest '92 from 7:30 AM-3 PM at the Iowa Nat'l Guard Armory, Summer St. Rd. (across from Burlington Municipal Airport). VEC Exams (bring photo ID and photocopy of signed license). Forums. Flights in Amateur Electronic Supply's Starship airplane mobile. Admission $4, children under 12 admitted free with an adult. Tailgaters $3 additional admission per space. Inside vendors, $6 per table plus admission fee. AC power limited. Set-up at 6 AM. Talk-in on 146.79 (146.19 input) WØLAC rptr., and 146.52 simplex. New and used dealers and computer stuff. Contact ***Chuck Gysi N2DUP, Burlington Hamfest '92, P.O. Box 974, Burlington IA 52601-0974***, or call ***(319) 752-3000***.

SEPT 12

BALLSTON SPA, NY The Saratoga County R.A.C.E.S. Assn., Inc., will host Hamfest 92 at the County Fairgrounds in Ballston Spa NY, rain or shine. Directions: Interstate Route 87 to Exit 12; follow orange and white hamfest signs. Set-up Fri. from 7 PM-8:30 PM. Limited camping w/hookup Fri. night, $15 plus tax. Admission $4 per person (includes 1 tailgate spot). Inside tables $5 ea. first come, first served (we encourage pre-payment). New and used equipment. Talk-in on WA2UMX rptrs., 146.40/147.00 and 147.84/24. Contact ***N2FEP, P.O. Box 41, Rock City Falls NY 12863***.

DALTON, GA The Dalton ARC will hold the Dalton Trade/Swap Day at Praters Mill on GA Hwy #2, 7 miles north of Dalton. Bring your own tables, chairs, tailgates, etc. Free admission. Members of DARC will be on site Fri. eve. for early arrivals (RVs, campers, etc.). Come as early as you wish and stay as late as you wish. No reservations. Talk-in on 145.230-, 443.000+ PL 203.5. For info call ***KB4MJW @ (706) 226-2583*** anytime.

DUCK HILL, MS N5UHW and Grenada Lake ARC will sponsor the 10th Annual Bogue Creek Festival at Duck Hill Community House, next door to the Post Office in Duck Hill MS, from 8 AM-12 PM local CDT. Bring your own swap tables. Walk-in VE Exams at 1 PM; bring original and copy of FCC license, original and copy of any CSCEs, a photo ID and $5.40. Talk-in on 146.700 (-600). SE Station N5UHW will be in operation. Contact ***Paul E. Wood N5UHW, P.O. Box 292, Duck Hill MS 38925-0292. Tel. (601) 565-7286***.

ELMHURST, IL The 40th annual Convention of W9DXCC will be sponsored by the Northern Illinois DX Assn. (NIDXA). W9DXCC membership includes every holder of DXCC in the 9th call area—about 7,800 active DXers. The program will include talks on recent DXpeditions, new and effective equipment and techniques, DX packet cluster, station aids, etc. For info, contact ***NIDXA, P.O. Box 519, Elmhurst IL 60126***.

ERIE, PA The Radio Assn. of Erie will host Erie Hamfest '92 at Rainbow Gardens, adjacent to Presque Isle State Park, from 8 AM-2 PM. ARRL sanctioned. There will be VE Exams at 8 AM at Room 107, Villa Maria Campus, 2551 W. 8th St. Admission $4. 12' tables $8. No tailgating. Talk-in on 146.01/61. For info, contact ***Tom McClain N3HPR, 3954 Solar Dr., Erie PA 16506. Tel. (814) 833-1640***.

LAPORTE, IN The LaPorte ARC Fall Hamfest will be held at LaPorte County Fairgrounds, State Rd 2 West. Admission $4. Tailgating free. Tables $5 each. Talk-in on 146.520. For tables and info contact ***Tom Lewis KA9ZUM, c/o LPARC, P.O. Box 30, LaPorte IN 46350. Tel. (219) 362-6848***.

UNIONTOWN, PA The Uniontown ARC will hold their 43rd Annual Gabfest on the Club grounds on Old Pittsburgh Rd., just off route 51 and the 119 by-pass. Talk-in on 147.045/.645 and 145.17/144.57. Contact ***U.A.R.C., c/o John Cermak WB3DOD, P.O. Box 433, Republic PA 15474. Tel. (412) 246-2870***.

SEPT 13

FINDLAY, OH The Findlay Radio Club, Inc. will hold its 50th annual Hamfest at the Hancock County Fairgrounds, East Sandusky at Fishlock, in Findlay OH. Advance tickets $4 ea., $5 at the gate. Reserved tables $12 for the first (includes admission for 1) and $8 for each additional table. Make check payable to ***Findlay Radio Club, Inc.*** and send with SASE to ***FRC Tables, Box 587, Findlay OH 45839***.

JOLIET, IL The Bolingbrook ARS will host Hamfest '92 and Computer Fair at the Inwood Rec. Center, 3000 W. Jefferson St., Joliet IL, starting at 6 AM. Gymnasium opens 8 AM Sun. Dealer set-up Sat. 6PM-8 PM; Sun. 5 AM. Overnight parking, no hookups. Advance tickets $4, $5 at the gate. Reserved dealer tables indoors, $10. Reserved Flea Market tables Indoors, $6. Any remaining indoor space will be available on a first-come first-served basis. VE Exams, walk-ins welcome. Bring original license and photocopy, ID and photo ID, plus test fee. Novice tests free. Talk-in on 147.33 +0.6, 224.54 -1.6, 146.82 -0.6 MHz. For info call ***(708) 759-7005***. To reserve tickets, mail your check and SAE to ***Bolingbrook Amateur Radio Society, P.O. Box 1009, Bolingbrook IL 60440***. To reserve tables, write to ***BARS, P.O. Box 1009, Bolingbrook IL 60440. Tel. (708) 759-7005***.

SOUTH DARTMOUTH, MA The South Eastern Mass ARA will hold its 5th annual Hamfest/Flea Market from 8 AM-3 PM at the Club grounds, 54 Donald St., South Dartmouth MA. Admission $2. Tables $8 in advance, $10 at the door. Talk-in on 147.00/.60 and 145.49/144.89. Contact ***Michael Enos, P.O. Box 79604, North Dartmouth MA 02747***.

SEPT 19

BERLIN, VT The Central Vermont ARC will hold the 4th annual Fall Foliage Hamfest/Fleamarket inside the Nat'l Guard Armory in Berlin VT. Directions: Exit 7 I-89, turn left at third set of lights. Admission $2. Tailgating $4. Inside tables $6 in advance, $8 at the door. For table reservations and info, contact ***Tom Girardi WA1YNU, P.O. Box 53, Plainfield VT 05667. Tel. (802) 426-3789***. ARRL VE Exams at 1 PM. Talk-in on 146.625 W1BD rptr.

CALGARY, ALBERTA, CANADA The 7th annual Calgary Ham Radio Flea Market, sponsored by the Novatel ARC, will be held from 0900Z-1200Z at the Parkhill Community Centre, 4013 Stanley Rd. SW, Calgary, Alberta. Admission $3. Tables $3. Talk-in on VE6NRC 146.76 and 146.52 simplex. To reserve a table, send your name, callsign and $3.00 for each table you would like, to ***Novatel Amateur Radio Club, 208 Canterbury Pl. SW, Calgary, Alberta, Canada T2W 1P4***.

FRANKLIN, PA The Fort Venango Mike & Key Club will hold a Ham Auction-Fest at the Venengo County 4-H Fairgrounds, Route 62 between Polk and Franklin PA. Free parking. Gates open at 8 AM. Auction begins at 10 AM. Admission $2/person, children 12 and under admitted free. Limited indoor flea market spaces $5 ea., bring your own tables. Talk-in on 147.12+, 145.23- and 145.19-. Contact ***Jim Clinefelter N3BAT, (814) 437-1781***; or ***Bruno Wolozyn K3MHB, (814) 677-8694***. Or write to ***Fort Venango Mike & Key Club, RD #1, P.O. Box 591, Cranberry PA 16319***.

SEPT 19-20

MILTON-FREEWATER, OR The 46th annual W7DP Hamfest, sponsored by the Walla Walla Valley ARC, will be held from 8 AM-5 PM at the Community Bldg. in Milton-Freewater. Registration/Admission is FREE. Swap tables (radio gear only, please) are $5. XYL activities. Potluck. ARRL Section Meeting. For VE Exams on Sun. afternoon, bring photo ID, a copy of your license, and $5.40. Talk-in on the 147.28/.88 rptr. Contact ***Carl Eisner N7PVW, 223 W. Chestnut, Walla Walla WA 99362. Tel. (509) 522-1270***.

PEORIA, IL The Peoria Area ARC will sponsor SUPERFEST 92, its 33rd annual Hamfest, at Exposition Gardens, Northmoor and University. Free parking, wheelchair accessible. Overnight camping. Flea Market opens at 6 AM. Commercial bldgs. open at 8 AM. Admission is $5 for the weekend. Forums. Manufacturer Reps. Ladies activities on Sat. VE Exams Sun. For info. contact ***PAARC, P.O. Box 3508, Peoria IL 61612-3508***, or call the Club answering machine at ***(309) 685-6698***.

VIRGINIA BEACH, VA Tidewater Radio Conventions, Inc. will hold the 17th annual Virginia Beach Hamfest/Computer Fair in the Virginia Beach Pavilion and Convention Center Sat. from 9 AM-5 PM; Sun. 9 AM-4 PM. Free parking at the doors. Admission $5 in advance, $6 at the door (good for both days). The Radisson Hotel is next door to the Pavillion, and the Atlantic Ocean is within walking distance. Gordon West WB6NOA will be the featured speaker. Exhibitors and dealers, contact ***Lewis Steingold W4BLO, (804) 486-3800***. For tickets and info contact ***Manny Steiner K4DOR, 3512 Olympia Ln., Va. Beach VA 23452. Tel. (804) 340-6105***.

SEPT 20

ADRIAN, MI The Adrian ARC will hold its 20th annual Hamfest/Computer Show at the Lenawee County Fair Grounds, North Dean St., Adrian MI, from 8 AM-2 PM. Tickets $3 in advance, $4 at the gate. VE Exams, inside Table Sales, outside Trunk Sales. Talk-in on 145.370. For reservations and info, contact ***Dennis Boydston, 2383 E. Clearview Dr., Adrian MI 49221. Tel. (517) 265-8054 after 4 PM EDT***.

BEACH HAVEN, PA The Columbia-Montour ARC will hold its 2nd annual Hamfest/Computer/Electronic Fleamarket at the Beach Haven Carnival Grounds, north of Berwick PA, on RT 11 near the Susquehanna steam electric plant, beginning at 8 AM. Breakfast at 6 AM. General admission $3, XYL and kids under 16 admitted free. Tailgating $1 per 8' space plus general admission. Talk-in on 147.225 or 146.52. Vendors: for info call ***Dave WC3A, (717) 752-6851***.

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market from 9 AM-2 PM at Albany and Main St. Free off-street parking. Admission $2. Covered tailgate area. Sellers spaces $5 in advance (includes 1 admission), $8 at the gate. Set-up at 7 AM. For space reservations or info, call ***(617) 253-3776***. Mail advance reservations before the 5th to ***W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139***. Talk-in on 146.52 and 449.725/444.725 - pl 2A W1XM rptr.

MT CLEMONS, MI The 20th annual L'Anse Creuse ARC Swap and Shop will be held from 8 AM-2 PM at L'anse Creuse High School. Directions: From I-94 take exit 236 onto eastbound Metro Pkwy, then to Crocker Blvd; left onto Crocker, then right onto Reimold to the last school. Admission $3 in advance (by Sept 8th), $4 at the door. VE Exams at 11 AM. Contact ***Don WA8IZV, (313) 294-1567.*** Tables $10. Trunk sale space $4 per space at the swap. Vendor set-up at 6 AM. For more info send SASE to ***Jerry Luh KA8QBC, (313) 651-7387, 732 Brookwood Ln., Rochester Hills MI 48309.***

PENNSAUKEN, NJ The South Jersey Radio Assn. will sponsor its 44th annual Hamfest/Computer Show at the Pennsauken High School parking lot, rain or shine, from 8 AM-3 PM. Free parking. Tailgating. Swap shop. VEC Exams, all classes; register at 9:30 AM. Advance tickets $4, $5 at the gate. Tailgate, 8' space, $5 (does not include admission). K2AA Talk-in on 145.290 (-600), SJRA rptr. For advance sales, send check and SASE to ***Alan Sherman KE2VX, 222 Park Ave., Atco NJ 08004. Tel. (609) 768-8380 eves. after 7:30 PM.***

SANDY HOOK, CT The Candlewood ARA of Danbury CT will hold its annual Ham Fest at Sandy Hook Fire House, Riverside Rd., from 8 AM-2 PM. Tailgating $6. Inside Tables $8 on first-come first-serve basis. Commercial vendors welcome. Talk-in on 147.12/.72 (PL 141.3) Danbury rptr. Contact ***John N2DVX, (203) 438-6782,*** or ***Craig N1ABY, (203) 426-1652.***

SEPT 26

BELTON, TX HAM EXP.O. '92, the largest indoor Tailgate Swapfest in Texas, will be held at the Bell County Expo Center. Take I-35 (exit 292). Wheelchair accessible. Free admission. VE Exams. There will be a fully equipped test bench for equipment checks. Set-up at 6 AM. Open to the public 8 AM-3 PM. Seller pre-registration $8 by Sept. 19th, $10 after. Your choice of 8' table or indoor tailgate space. Additional tables $4, $5 at the door. Electricity $2. Registration/checks to ***Temple ARC, 2014 S. 53rd, Temple TX 76504.*** Contact ***Mike WA5EOQ, (817) 773-4768.***

ELMIRA, NY The Elmira ARA will present the 17th annual International Hamfest at the Chemung County Fairgrounds. Outdoor Flea Market. Indoor Dealer Displays. Gate will be open from 6 AM-5 PM. Tickets available at the gate, or in advance from ***Dave Lewis, RD1, Box 191, Van Etten NY 14889.***

SANTA FE, NM The Northern New Mexico ARC will host the 1992 Northern New Mexico Hamfest at Glorieta Baptist Conference Center, 16 miles southeast of Santa Fe on I-25, exit 299. Flea Market. Free Tailgating for registrants. Overnight camping with hookups at $9.30 per night. Camping without reservations is on a first-come first-served basis. Contact the ***Glorieta Baptist Conference Center, P.O. Box 8, Glorieta NM 87535,*** with remittance, to secure your spot for Fri. and/or Sat. night. Hotel/motel rooms are available—call ***(505) 757-6161*** for info. Admission is $5 at the gate. Talk-in on 146.18/.78 and 146.52/.52. Contact ***Helenrose Burke W5IXS, P.O. Box 73, Ojo Sarco NM 87550. Tel. (505) 689-2367.***

WARSAW, IN The American Red Cross ARC of Warsaw will sponsor its 2nd annual Warsaw Hamfest from 8 AM-2 PM at the Nat'l Guard Armory, 2 miles north of Warsaw. Take Ind. 15 North to Co. Rd. 350 N. Turn East, it's just across the tracks. Tickets $3.50 in advance, $4 at the door. Tables $5. Tailgate sales free with admission. W5YI VE Testing. Talk-in on 146.985 or 442.55 rptrs. For info call ***John Sparks KA9QWV, (219) 269-5187; Harold Dunn KA9TUQ, (219) 269-9652; Paul Van Dyke KB9AVO, (219) 457-5432.*** Dealers write to ***ARC2 Hamfest 92, 1516 Maye St., Warsaw IN 46580. Tel. (219) 269-5187.***

SEPT 26-27

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL Great Lakes Div. Convention will be held at the Commonwealth Convention Center in downtown Louisville. Advance tickets $6 with SASE; $8 at the door. Commercial and flea market spaces available. For tickets or info, mail to ***P.O. Box 34444-S, Louisville KY 40232-4444. Tel. (502) 551-4118.***

WICHITA, KS The Wichita ARC will host the 1992 Kansas State ARRL Convention at the Ramada Hotel at Broadview Place, 400 West Douglas, Wichita KS 67202. For more info contact the ***Wichita Amateur Radio Club.***

SEPT 27

LONDON, ONTARIO, CANADA The London ARC will hold its 15th annual Hamfest at the Pot O'Gold Bingo Palace, Hamilton and Gore Rds, London Ontario from 9 AM-2 PM. $5 Admission includes door prize ticket. Vendor set-up 8 AM. Tables $5. Talk-In VE3LON 147.060+. Send reservation payments to ***London Amateur Radio Club Inc., P.O. Box 82 STN B, London, Ontario Canada N6A 4V3.*** For info call ***Jim Hartford VE3NRX, (519) 672-7911.***

LONGMONT, CO The Boulder ARC will host its Amateur Radio Electronics and Computer Swap Meet at the Boulder County Fairgrounds Exhibition Bldg., Nelson and Hover Rds., Longmont CO. Free parking. Camp sites and shopping nearby. VE Exams. Set-up at 7 AM. Doors open at 8 AM. Admission $3. Tables $7 (chairs available). Call ***(303) 530-2903*** to obtain table reservation forms or make VE testing reservations. Mail table reservations and inquiries to ***BARCFEST, 1103 South Gay Dr., Longmont CO 80501.*** Reservation deadline is Sep. 19th. Walk-ins welcome, first-come, first-served.

MILFORD, CT The Coastline Amateur ARA will sponsor VE Exams for all classes at the Fowler Bldg., 145 Bridgeport Ave., Milford CT, starting at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125,*** or ***Dick WA1YQE, (203) 874-1014*** for more info.

NEW PORT RICHEY, FL The Suncoast ARC will hold the 2nd Pasco County, Florida Hamfest at the New Port Richey Recreation Center from 9 AM-5 PM. Directions: US Hwy. 19 to Main St. in NPR; go east 1.5 miles to Van Buren. Turn left (north) 1 mile on right side. W5YI Exams. Admission $5 at the door, children under 12 admitted free. YL and XYLs free. Sellers $15 (pre-registration required). Tables $15, includes chair and one admission. Electricity is $5 extra. Talk-in on 145.35 local, and 147.150 distance. Contact ***Suncoast Amateur Radio Club, P.O. Box 7373, Hudson FL 34676*** or call: ***Ralph N4QIK, (813) 847-4043,*** or ***Mitch KM4MU, (813) 848-5526.***

YONKERS, NY The Metro 70cm Network will sponsor a Giant Electronic Fleamarket at the Lincoln High School, Kneeland Ave., off Yonkers Ave., from 9 AM-3 PM. Set-up at 7 AM. Ham Gear. Computers. VE Exams. Free parking. Free frequency checks. Admission $4 each. Kids under 12 free. First table $15; $10 each additional. $1.80 per foot (your table min. $10.). Full payment in advance. Contact ***Otto Supliski WB2SLQ, 53 Hayward St., Yonkers NY 10704. Tel. (914) 969-1053.***

OCT 3

CHERRY HILL, NJ The Pack Rats (Mt. Airy VHF Radio Club, Inc.) will sponsor the 16th annual Mid-Atlantic States Conference and Banquet on Sat. Oct. 3rd. For more info send #10 SASE to ***VHF Conference, P.O. Box 311, Southampton PA 18966.***

ROCK HILL, SC The York County ARS will hold its 41st annual Rock Hill Hamfest at the Charlotte Knights Baseball Stadium just south of Charlotte NC on I-77, from 7 AM-5 PM. Advance tickets $5, $6 at the door. One parking space included. Wheelchair accessible. Covered display space. VE Exams. Flea Market. Camping nearby. Talk-in 147.030 (-600). For info and advance tickets contact ***Tom Lempicke AB4YV, 2129 Squire Rd., Rock Hill SC 29730. Tel. (803) 328-3837.*** Please SASE.

OCT 3-4

BILOXI, MS The Mississippi Coast ARA, Inc. will hold its 16th annual Ham/Swapfest at the Mississippi Coast Coliseum and Convention Center. VE Exams Sat. at 1 PM, Sun. at 11 AM. Admission $2. Weekend table rental $15 by pre-registration only. Free parking. Handicap parking. RV hookups and dump station $10 per night. No tailgate spaces or outside tables available. No commercial dealers or equipment sales in swap area. Contact ***Ernie Orman W5OXA, 15625 Little Joe Rd., Biloxi MS 39532. Tel. (601) 392-2816.***

OCT 4

CHERRY HILL, NJ Hamarama '92, sponsored by the Mt. Airy VHF Radio Club, Inc., will be held rain or shine at Garden State Park, Rt. 70 and Cornell Ave. from 7 AM-4 PM. Buyers $4 admission plus $1 parking. Sellers add $8 each 10 x 20 parking space (bring your own tables). For info send #10 SASE to ***Hamarama '92, P.O. Box 311, Southampton PA 18966.***

SPRINGFIELD, OH The Springfield Independent Radio Assn. (SIRA) will sponsor the Springfield Hamfest/Computer Expo at Clark County Fairgrounds on State Route 41, just north of I-70, from 8 AM-3 PM. Advance tickets $4, $5 at the door. Advance tables $8, $10 at the door, if available. Talk-in on 145.45/R(-), 224.26/R(-). For more info, write ***SIRA, P.O. Box 523, Springfield OH 45501,*** or call ***Hamfest Chairman Ralph Pamer WA8KSS, (513) 325-1456.***

OCT 11

LIMA, OH The Northwest Ohio ARC of Lima OH will host a Hamfest at the Allen County Fairgrounds, Rt. 309E off I-75 Exit 125A-B. Advance Tickets $4, $5 at the door. On-site camper parking, $7 for electric hook-up. Security guards all night. Gate opens at 6 AM. All areas are wheelchair accessible. Set-up Oct. 10th, 3 PM-11 PM; Oct. 11th, 5 AM. Tables $8. Send check or money order with SASE at least two weeks in advance to ***WD8BND, P.O. Box 211, Lima OH 45802.*** To pre-register for VE Exams, send completed 610 form, copy of license, check for $5.40 made out to ***ARRL VEC.*** Send to ***W8TY, P.O. Box 211, Lima OH 45802.*** On a separate sheet of paper, please state which elements of exams you wish to take. Cutoff for Exams registration is Oct. 3rd. Talk-in on 146.67, 145.17, 444.925 Std. Splits.

SPECIAL EVENT STATIONS

ANNOUNCEMENT:

UFO/ET Discussion NET Join us every Thurs. evening, 8 PM-11:30 PM on 3.930 MHz, for discussions related to extra-terrestrial communications and the UFO phenomena. NET controls are Tom KA1DYE, and Kenny N1JVN.

SEPT 2-7

MOUNT PLEASANT, IA The Mount Pleasant, Iowa ARC will operate WØMME at the 43rd Annual Midwest Old Threshers Reunion. Operation will be the bottom 50 kHz of the General 80-10 meter phone subbands plus the 80m, 40m, and 15m Novice bands. For a QSL, send SASE to ***Dave Schneider WDOENR, RR #3, Box 307A, Mount Pleasant IA 52641-9803.***

SEPT 12

DUCK HILL, MS The Grenada Lake ARC will operate Station N5UHW (and others) in conjunction with the 10th annual Bogue Creek Festival. Time: 0000Z-2400Z. Frequencies: 3.875, 7.250, 14.250, 21.350 and/or 28.350 +/- (depending on QRM, QRN, and propagation). Packet: Rose System 601453 N5UHW-1 (145.07). Talk-in on 146.700 (-600). Send QSL and SASE to ***Bogue Creek Festival, Special Event Station N5UHW, P.O. Box 292, Duck Hill MS 38925-0292 USA.*** For info contact ***Paul E. Wood N5UHW, P.O. Box 292, Duck Hill MS 38925-0292. (601) 565-7286.***

SEPT 12-13

MONTANA QSO PARTY The Montana H.F. Soc. will sponsor their 1992 Montana QSO Party from 1600 UTC Sat.-0400 UTC Sun. for Class I Single Operator and Class II Single Operator, Mobile (Montana only). Montana stations send QSO number and country. Stations outside Montana send QSO number and state/province/county. Each SSB contact is worth 1 point.

CW, RTTY, AMTOR contacts worth 2 points. Frequencies: 80-10m SSB—3850, 7230, 14280, 21350, 28450. CW band edge plus 25 kHz. Novices use band edge plus 50 kHz. A plaque goes to highest scoring station out of Montana. Certificates to the highest scoring entry from each state, province, or country, with at least 25 QSOs and contacts with at least 10 diffferent Montana stations. Plaque to highest scoring Montana station, certificates to 2nd and 3rd places, and Top Mobile. Report log and summary sheet listing QSOs and multipliers by band, mode, total contacts, multipliers, claimed score, name, call, mailing address, phone, and a written signed statement of 'Fair and Ethical Operation." Entries with more than 200 QSOs must include dupe sheets. You may submit your entry on disk in lieu of paper logs. Disk must be MS-DOS format, 5 1/4 inch, 360 K disk only and in an ASCII file containing all of the previous info. A separate summary sheet and signed statement is also required with disk entries. All entries must be postmarked by Oct. 1, 1992. Please mail to ***The Montana H.F. Society, 1009 Madison Ave., Helena MT 59601.*** Include a business size SASE for results.

TULELAKE, CA The Keno ARC will host their 2nd annual Special Event Station, KG7VM, at the Tulelake Fair from 1600Z-0000Z Sat. and Sun. Operation will be on 10-80m as follows: SSB on lower 20 kHz of the General and Novice portion; CW on the lower 20 kHz of the Novice, and RTTY on the applicable part of the General subbands. For a certificate, send QSL and a business sized SASE to ***Keno ARC, P.O. Box 653, Keno OR 97627.***

SEPT 14-19

ATLANTIC CITY, NJ Southern Counties ARA (SCARA) will operate K2BR from the Miss America Pageant in Atlantic City NJ. Atlantic City is located on Absecon Island, which is IOTA: NA 111. Frequencies: Phone: 25 kHz inside lower General class bandedge. CW: 65 kHz inside lower General class bandedge. Novice: 28.100-28500 kHz. QSL with #10 SASE via ***SCARA, P.O. Box 121, Linwood NJ 08221.*** Operation will begin from 10 AM EST on Sep. 14th.

SEPT 18-20

PORT VUE, PA Station KI3R will operate on 40m, 20m, and 10m bands during daylight and evening hours, in celebration of the 100th Anniversary of Port Vue Borough. QSL with SASE to ***KI3R, 1008 Monroe Ave., Port Vue PA 15133.***

SEPT 19

FLAG CENTER, IL The Kishwaukee ARC of Dekalb County IL will host Station WA9CJN for the Two Rivers Council Boy Scouts to help commemorate the 500th anniversary of the discovery of America. This fall camporee is being called a "Quintaree." WA9CJN will operate from 1300Z-0300Z with most activity on the Novice portion of 10m. Control operators will be KB9AGV and WB9EEE. For a certificate, send a large SASE to ***KARC WA9CJN Attn: KB9AGV, P.O. Box 264, Sycamore IL 60178.***

SEPT 19-20

VANCOUVER, WA The Heritage Trust Foundation of Clark County WA will sponsor Station W7AIA, possibly operating from the famous Officer's Row at old Fort Vancouver barracks. Operation will be from 1600 UTC-2300 UTC Sat., and from 1700 UTC-2200 UTC Sun., in the lower portion of the General class phone bands, 40m and 20m, and in the 10m Novice/Tech band, conditions permitting. A nice certificate will be available in return for your SASE to ***CCARC, P.O. Box 1424, Vancouver WA 98668.***

SEPT 25-27

PEA PATCH ISLAND, DE The Quad County IRC will operate KD3XN 1400Z-2100Z from historic Civil War Fort Delaware. Operations will be in the General and Novice portions of 10m, 12m, 15m, 17m, 20m and 40m. For color aerial view QSL, send QSL and SASE to the operator worked. Possible IOTA.

SEPT 26

PESHTIGO, WI The Marinette and Menominee ARC will operate Station WJ9X from the site of the 121st Anniversary of North America's most disasterous forest fire. Operations will be from 1500Z-2300Z. Frequencies: Phone 14.271, 21.371, 28.471 and 14.071 CW. For certificate and honorary Peshtigo citizenship, send SASE to ***William Fluegge, N3280 River Bend Dr., Peshtigo WI 54157.***

SEPT 26-27

KINGMAN, AZ The Hualapai ARC will operate Station WA7LAZ to celebrate "Andy Devine Days," an annual event in Kingman AZ, where Andy spent his youth. Andy, most remembered for his character "Jingles" in many western movies, was licensed as W6RER (Red Eyed Rooster). Some of his amateur equipment and other memorabilia is on display in the Mohave Museum. Operating schedule: 1500Z-1700Z, 28.325 MHz; 1700Z-1900Z, 21.325 MHz; 1900Z-2100Z, 14.325 MHz; 2100Z-2300Z, 28.325 MHz; 2300Z-0100Z, 21.325 MHz; 0100Z-0300Z, 14.325 MHz; 0300Z-0500Z, 28.325 MHz. If propagation is bad on any band we will shift to the next lower band. For a certificate suitable for framing, send QSL with contact number, and a 9 x 12 envelope with two units of postage to ***WA7LAZ, P.O. Box 4364, Kingman AZ 86401***, or send $1.00 with QSL and we will furnish envelope and postage.

OCT 1-2

HUMACAO, PR The Bayamon Central University ARC will operate Station ACTE-KP4 to commemorate the Annual Convention of the Assn. for Educational Communications and Technology, Puerto Rico Branch, in Palmas del Mar Resort, Humacao PR. Frequencies: 145.15, 28.477, 21.137 and 3.737 MHz. Contact the station in one frequency to get a QSL card, two or more frequencies to get a certificate. Send QSL and SASE to ***Carlos Colon KP4TD, School of Education, U.C.B., Box 1725, Bayamon PR 00957.***

OCT 3

ALAMOGORDO, NM The Alamogordo ARC will conduct a special operation, sponsored by the International Space Hall of Fame, to honor new inductees. Station WA5IPS will operate from 1500 UTC-2300 UTC, from atop the Space Hall. Operation will be in the 10m Novice band (around 28.480/.490 MHz) from 1500 UTC-1600 UTC, and on the 15m and 20m General phone bands from 1600 UTC-2300 UTC. Special QSLs will be sent from the Space Hall of Fame and will be certified by A.A.R.C. members. QSL requests should be mailed to ***International Space Hall of Fame, Route 2001 - P.O. Box 533, Alamogordo NM 88311-0533.*** No SASE required. SWL requests will also be acknowledged. For more info, contact ***Ole Jorgensen WA5IPS, Chairman; Larry Moore WA5UNO, A.A.R.C. President.***

OCT 10-11

BOALSBURG, PA The Nittany ARC will operate W3YA from the authentic Columbus Family Chapel historic museum during festivities for the Quincentennial of Christopher Columbus' discovery. Hours: 1500 UTC-0100 UTC Sat. Oct. 10; 1400 UTC-2200 UTC Sun. Oct. 11. SSB: Lower 25 kHz of General 15m, 20m, 40m, 80m phone bands and Novice portion of 10m. CW: lower 25 kHz of General 15m, 20m, 40m code bands and Novice portions of 10m and 80m. Visitors talk-in on 146.76- and 146.85-. Send QSL and SASE for QSL card, or QSL and $1 for flat, unfolded certificate to ***CC500 Committee, Nittany ARC, P.O. Box 614, State College PA 16804-0614.***

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Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

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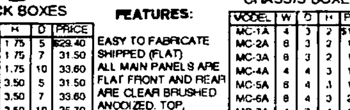

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RANDOM OUTPUT

David Cassidy N1GPH

A few months ago, I wrote in this space that the debate over the codeless license was a moot point—that it had proved itself successful and a positive change for amateur radio. At that time, I said it was time to move on to other matters. It seems that I was wrong, and one more time I feel compelled to beat this dead horse.

I was checking messages on my local packet BBS the other day when I came across something that shocked and angered me (I wish I had made a copy of the message, so I could give it to you verbatim). The packet message told a story of an amateur radio club that restricted its members who were Technicians by not allowing them to use autopatch on the club's repeater and by not letting them vote in club elections. The writer wanted other people's opinions on whether or not this was legal.

While the policy of this club may be legal (after all, it is their equipment and organization, and they can do whatever they want), I don't think the legality of their actions is the point. The point (other than why anyone with an ounce of common sense would choose to associate with these self-inflated snobs) is what this group is saying about amateur radio. We are in a hobby that focuses on communications. So, what exactly is this club communicating?

"We think we are better than certain other amateurs."

"We don't care about the future of amateur radio."

"We are boring people, and we could care less about new ideas."

"We're not interested in helping newcomers to this hobby."

"If we don't already know you, stay off our repeater!"

Is this what we want? Is this the spirit of the Amateur Radio Service?

I have something I'd like to say to this club, its officers, and any other group or individual who thinks there is room for this kind of prejudice in amateur radio: We don't need you or your back-of-the-bus mentality. You are hurting amateur radio, and if you can't control your zealous hatred, please do us all a favor and crawl back under the rock from which you emerged. Face it. Amateur radio has a codeless license. Eventually, Morse code will be dropped from all license classes. So why don't you just leave now and let the rest of us work on the future of this hobby?

Phew! I feel a lot better.

If You're Not Part of the Solution . . .

The future of amateur radio is not tied up in whether you or I like or don't like having the Morse code as an element of amateur radio license testing. The future of amateur radio *is* very much tied up with whether or not we tolerate the kind of regressive, bigoted ignorance displayed by the ham club mentioned above. If we can't stop living in the past, which includes hanging on to a century-old communications mode as a licensing requirement, how are we going to help pioneer and popularize spread spectrum, digital voice and video, personal satellite communications, etc.?

Do not delude yourself into thinking that we can't help pioneer these technologies, because we *must*. If we do not find justification for the existence of an Amateur Radio Service by providing advances and testing new communications modes, there will no longer be an Amateur Radio Service. Our frequencies are too valuable (not just to U.S. companies, but to the world), and the old reasons for our existence are no longer valid.

If we are going to enter the 21st Century with anything even resembling amateur radio as we now know it, we have to look towards the future, and guard against the harmful and hurtful attitudes of clubs like the one I mentioned.

A Call to Action

First of all, if you are involved with a club like the one mentioned above, GET OUT! Why should you lend your support to a bunch of ignorant bigots? Stay off their repeater, too. Without a regular infusion of new blood, they will eventually wither up and blow away.

What do you do now? Get a couple of local hams together and start your own club. You don't have to have a fancy clubhouse and a club station and a repeater to start a club. Meet in a different member's home every month. Choose a relatively inactive repeater and make it your home base (that shouldn't be too tough, since *most* repeaters are inactive). Plan fun and interesting meetings and activities, and the local hams who really care about amateur radio will flock to join your club.

One final thing. I want to hear from you. *All* of you. I want to know if there are other clubs out there like the one described above. I especially want to hear from new Technicians. Are you experiencing the same thoughtless bigotry?

I want you to name names. I want to know the names of the clubs, and the names and callsigns of the club officers. Don't worry, I'll keep your name out of this. I'll check out any information I get, and if I find clubs like the one above—clubs that are determined to hurt amateur radio—I'll see that the names of the clubs, as well as the names of the club officers involved, get printed in *73* and *Radio Fun*. We can call it "The Amateur Radio Hall Of Shame."

Write to me c/o *73 Amateur Radio Today*, 70 Route 202 North, Peterborough NH 03458.

Number 33 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

As I write this, June is coming to a close. You may recall in my June forecast the days of June 6th, 10th and 16th were "likely to be the focus of some extreme ionospheric upsets . . . and violent atmospheric storms around these dates." Well, we had the violent atmospheric storms all right, beginning on the 15th and extending to the 20th! A line of tornadoes extending from southwest to northeast marched across the U.S. and hit the states of Illinois, Michigan, Minnesota, Wisconsin and others, with much damage and even some fatalities. This period was considered by the National Weather Service to be the worst in many years. The bands weren't any too good, either, on the forecast "Poor" dates. On June 25th between 2100 and 2200 hours UTC, all the HF bands went "dead" from a major solar flare at 2042 hours, followed by a satellite proton event at 2045 hours. It takes a short while following eruption of a solar flare for the full effect to reach the earth and influence the ionosphere so drastically. The bands recovered gradually in about two hours and were in full service again on the 26th. It always seems that conditions turn from very poor to very good within a day of a major flare. The Earth's ionosphere is prodded into violent activity by the influx of particles from the sun . . . sometimes even for the better!

What about September—the subject of this report? You may expect similar effects of poor propagation and violent atmospheric and geophysical activity on the days surrounding the 10th, beginning as early as the 8th and possibly extending to the 12th. Early September until about the 15th is likely to show Fair to Poor to Very Poor conditions while the remainder of the month will probably exhibit Fair to Good to Very Good conditions.

September's autumnal equinox is a great time for DX to begin rolling in from all parts of the earth, and this month is likely to be no exception. Whereas the solar flux levels began going down abruptly in June, there is reason to believe that there will be a slight increase and consequent improvement of all HF band conditions from about September 15th to 30th. Magnetic field stability will increase, and the "A" and "K" indexes are likely to be low . . . all good signs for HF propagation. Although the bands *above*, say, 20 meters will begin closing at dusk and will not be open far into the night (except on Very Good days/nights) the bands *below* 20 meters, all the way down to 160 meters will improve greatly, and can afford all night DX from the USA to some part of the world or other. Short skip will also occur, but not as frequently as in mid summer. September marks the beginning of *excellent* fall conditions on the HF bands.

Please let me know through *73 Amateur Radio Today*, or directly, how these forecasts turn out for you. I am always interested in improving my "batting average" and need your input of comments, suggestions and ideas for this column. Thanks, and see you next month.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15*	20	20	20	—	—	—	—	—	—	—	15
ARGENTINA	15	15	20	20	40	—	—	10	—	—	10	1
AUSTRALIA	10	15	20	20	—	40	20	20	—	—	—	1
CANAL ZONE	15	40*	40*	40*	40*	—	20	10	10	10	10	1
ENGLAND	20	40	40	40	—	—	20	10	10	10	15	2
HAWAII	10	15	20	20	40*	40	20	20	—	—	—	1
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	15*	20	20	20	—	—	—	—	—	—	—	15
MEXICO	15	40*	40*	40*	40*	—	20	10	10	10	10	1
PHILIPPINES	—	—	20	20	—	—	20	15*	15*	—	—	—
PUERTO RICO	15	40*	40*	40*	40*	—	20	10	10	10	10	1
SOUTH AFRICA	40*	20	20	20	—	—	—	—	10	10	10	1
U S S R	—	40	20	20	20	—	—	10	10	15	20	2
WEST COAST	10	15	20	20	80/40	80/40	—	—	—	10	10	1

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	20	20	—	—	—	—	—	—	—
ARGENTINA	15	15	20	20	20	—	—	10	—	—	10	1
AUSTRALIA	10	15	15	20	20	40*	40	20	—	—	15	1
CANAL ZONE	15	15	20	20	—	40	40	10	10	10	10	1
ENGLAND	—	—	—	—	—	—	10	10	15	15	20	2
HAWAII	15	15	20	20	40*	40*	40	20	—	—	10	1
INDIA	—	20	—	—	—	—	—	20*	15	—	—	—
JAPAN	10	15	20	20	20	—	—	—	—	—	—	—
MEXICO	15	15	20	20	—	40	40	10	10	10	10	1
PHILIPPINES	15	—	—	—	—	—	—	20	10	10	—	—
PUERTO RICO	15	15	20	20	—	40	40	10	10	10	10	1
SOUTH AFRICA	20	20	20	—	—	—	—	—	10	10	15*	1
U S S R	—	—	20	—	—	—	20	15	15	15	20	2

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15*	—	20	20	20	20	20	20	20	—	1
ARGENTINA	10	15	15	20	20	20	—	—	10	—	10	1
AUSTRALIA	10	15*	15*	20*	20	20	40	—	—	—	—	1
CANAL ZONE	10	15	15	40/20	40/20	—	—	—	15*	10	10	1
ENGLAND	—	—	—	—	—	—	—	—	15	20	15	—
HAWAII	10	10	15	20	40*	40*	40	40	15	15	—	1
INDIA	—	20/15(1)	—	—	—	—	—	—	20/15(1)	15(1)	—	—
JAPAN	10	15*	—	20	20	20	20	20	20	20	—	1
MEXICO	10	15	15	40/20	40/20	—	—	—	15*	10	10	1
PHILIPPINES	10	10	—	—	—	—	—	—	20*	15	15	—
PUERTO RICO	10	15	15	40/20	40/20	—	—	—	15*	10	10	1
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	1
U S S R	—	—	—	20	20	—	—	—	15	15	20	2
EAST COAST	10	15	20	20	80/40	80/40	—	—	—	10	10	1

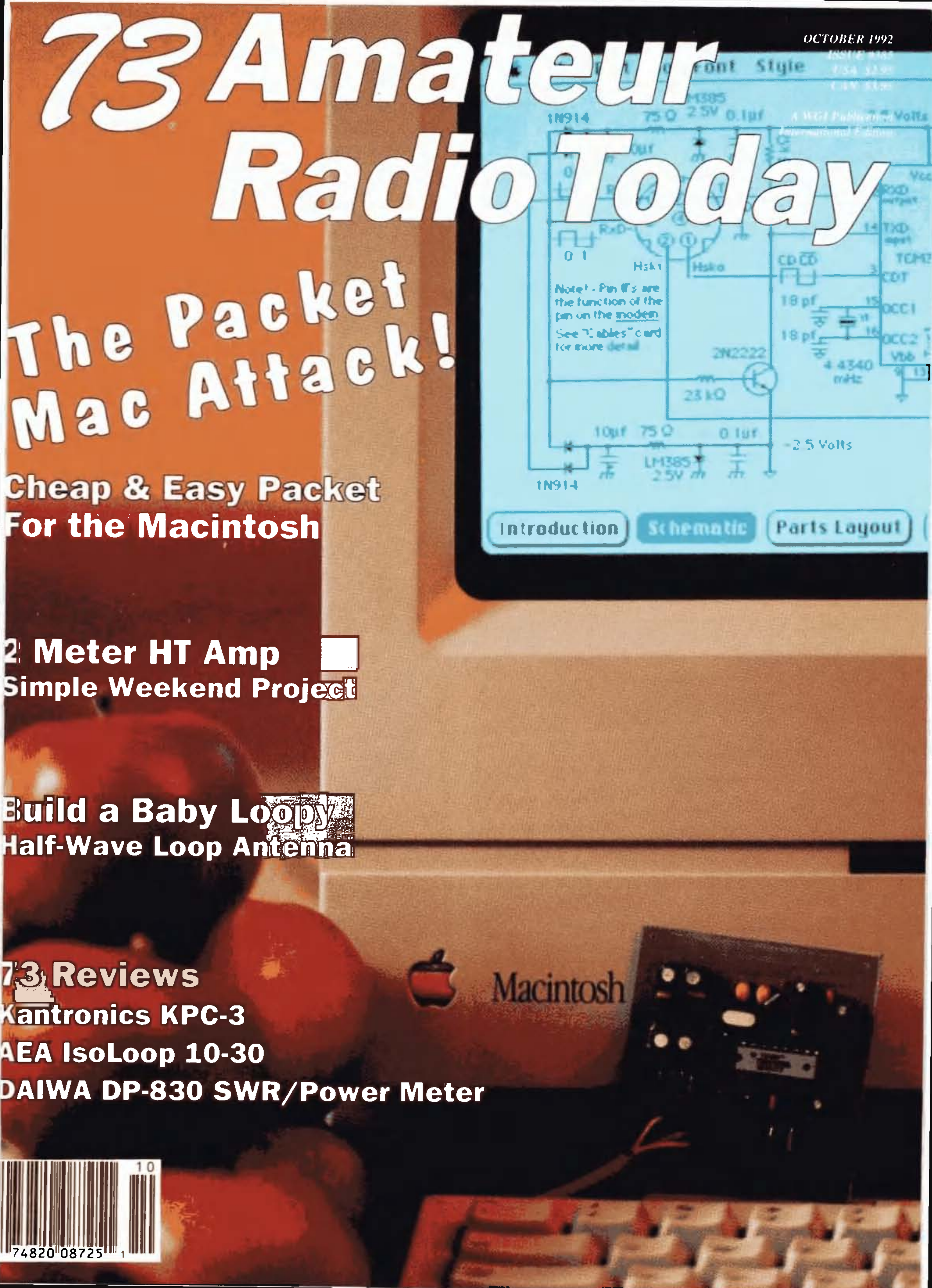
* Try next higher band (1) Difficult path

September 1992

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 F	3 F	4 F-G	5 G-F
6 F	7 F-P	8 P	9 VP	10 VP	11 VP	12 P
13 P-F	14 F	15 F	16 F-P	17 P	18 P	19 P-F
20 F-G	21 G	22 G-F	23 G-F	24 G	25 G	26 G
27 G	28 G	29 G	30 G			

73 Amateur Radio Today

OCTOBER 1992



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Cheap & Easy Packet For the Macintosh

2 Meter HT Amp
Simple Weekend Project

Build a Baby Loopy
Half-Wave Loop Antenna

73 Reviews
Kantronics KPC-3
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DAIWA DP-830 SWR/Power Meter

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LETTERS

Number 1 on your Feedback card

From the Hamshack

Paul Blankenship, Stinnett TX I've just read through my first issue of your magazine. I particularly enjoyed the "Propagation" and "Random Output" sections. However, why not have a department geared to the beginner? Most of the articles are too technical for the neophyte ham. I read the articles anyway, gleaning any information I can make use of, but I sure would like to understand the rest of it, too.

At this point I am unable to become an amateur radio operator and satisfy my thirst to make friends around the country and the world. The major expense of equipment has prohibited me from purchasing even used equipment that would broadcast past the end of the street. So, I guess I'll have to be content with listening to my shortwave receiver for the time being.

I have for years enjoyed scanning, shortwave listening and CBs. I still like to spend evenings talking to friends on my CB radio, but lately I have found this form to be too limiting. I would love to move up to ham radio if I could learn enough about it to warrant the massive expense.

Paul—We have a whole magazine devoted to newcomers. It's called Radio Fun, *and you can call 1-800-257-2346 to subscribe.*

Keep those back issues of 73 *and re-read them every six months or so. You'll be surprised at how much more you'll get out of them.*

I don't understand why you are "unable to become an amateur radio operator." All it takes is a study guide and a few weeks of work. Or, find a local club that's running a licensing class.

The "massive expense" of ham radio is a myth. You've already got a receiver, so pick up a used transmitter or build one. Put up a dipole and you're on the air. The total cost should be less than $100 . . . David N1GPH

Lester Earnshaw KB7FA, Sedona AZ I've received your letter pleading that I renew my subscription to *73*, that the ham industry is down to less than 25% of what it was 25 years ago and needs my subscription to revitalize it. I've also followed your editorialized commendable attempts to do something about the fall-off, and, for the most part, I agree with your various proposals to counter the problem. It's unfortunate, though, that you haven't shown like zeal in the publication of *73*'s technical articles. There was a time, years ago, when *73* was up with the state of the art, but now, alas, all we get are warmed over articles on antennas, on antennas, on antennas, or reviews of Japanese rice boxes.

Where, I ask, are the primers on microprocessors and the programming of them? On direct RF synthesis? On digitalized RF processing?

I submit that it's going to take more than harping on about the elimination of CW as a licensing requirement to draw young people to the fold—I do agree with you that CW should be relegated to its rightful place alongside the other modes, AM, FM, SSB, RTTY—but it's going to take the attractions that first brought people from spark to AM, to FM, to SSB: beginning articles, articles to get people started, articles on the basic programming of basic microprocessors, and follow-up articles. Forget about three-transistor 40 meter CW receivers; they don't have the stability to mix it in with today's transceivers, and besides, why would a kid, grown up with a Walkman glued to his ears, want to build a set of such simplicity, any more than I, in my youth, wanted to build resistors and capacitors once they became readily available?

Have you forgotten, Wayne, the old adage that man does not live by bread alone? Please, get some new stuff in there so that those with the zeal, and not necessarily a college education, can find out what's going on and keep up with it. Never mind articles on hashed-over antennas and CW keyers for the gas bags and the old farts like you and me; we're dying out anyway. Concentrate on the kids. Challenge them with the state of the art. They'll surprise you.

I enclose my subscription anyhow.

Stay tuned, direct digital RF synthesis projects are coming soon . . . Bill WB8ELK

Rodman Sharp N5NM, Santa Fe NM The rantings and ravings in your "Never Say Die" column are always my first read when *73* arrives in the mail. Over the years they've been the most delightful, aggravating, inspirational, infuriating and motivating stream of unrelenting genius of anything I read.

As one of the newly arrived Neanderthals in CW land, I want to thank you especially for the marvelous job you're doing trashing CW and doing everything you can to bury it. I hadn't used CW for a long time, but you piqued my curiosity to go way down band and see what's going on there, if anything.

As an Extra, I began prowling the lower 25 kHz of 20 meters and (I can hardly believe this) find it almost interference-free if I use narrowband filters. All I have is a trap vertical (antenna restrictions) so SSB on 20 meters, even with my big amplifier, is a real struggle to be heard, especially on weekends.

But amazingly, if I can hear them I can work them on 20 meters CW with 100 watts or less. My second rig is an Argonaut 515 and I began switching over to that after starting a QSO and find that about half the time I can sustain the contact with FIVE WATTS! Even the General class CW sector between 14025 and 14050 is surprisingly uncrowded most of the time.

It's not all brass pounders and bug ticklers down there in the lower 50 kHz of the 20m band, either. I find a lot of really bright hams running CW with computers, using keyboard entry at 25 to 50 wpm with automatic encoding and decoding to their CRT display. The NET-REAL-DATA rate is maybe three to 10 times higher on CW than the redundant and repetitious blah-blah QSOs on SSB. The CW sign-off "chow time Rod 73 and CUL" often requires 100 words plus on SSB.

Another discovery: lots of bright and enjoyable DX hams on regularly who love this keyboard CW stuff and many others who can hack 30 wpm and more on their end with keyers and ear-only decoding. Many have told me they're more comfortable using English as a second language on CW than on SSB, especially trying to UNDERSTAND all those strange American accents on SSB, which just don't seem to be there at all on CW. These folks DON'T KNOW CW is DEAD!

My URGENT PLEA to you, Wayne: Please keep up the good work by doing EVERYTHING you can to DISCOURAGE American hams from having anything to do with CW. That way, we'll keep the CW-only band sectors, even on 20 meters, as delightfully free of crowding, interference and pathological ham behavior as they now are.

Noted . . . Wayne

Art Stamler, Carrolton AL I've just returned from Guatemala, which has to be one of the world's poorer countries. There I was asked by an American retiree who works with emergency medical, fire and ambulance services if I knew of any source of used radio equipment that might be donated to these volunteer groups who have almost no means of communication in the event of disasters. And Guatemala has its share of disasters, from fire to earthquake to vehicular mayhem, and more.

What he asked for was: 1) person-to-person handhelds, mobile units for vehicle use, and base stations, and 2) whip antennas for the above, wherever possible. All units should be in good working order and, hopefully, have circuit manuals. Old tube transceivers are acceptable, as are 23- and 40-channel CBs.

There's a tax break possible for donors, for the value of the equipment donated plus the cost of packing and shipping. Send the equipment to me, care of "Partners of the Americas," P.O. Box 489, Carrolton AL 35447. I'll see that it gets to Guatemala. Many thanks for your generosity. I'll send receipts by return mail, with a tax ID number.

Robert Beeman K4NZL, Roswell GA Your "Never Say Die" column in the August 1992 issue of *73 Magazine* struck a responsive chord with me. Being unemployed at the moment, I have had a lot of time to reflect on exactly why I am in this situation. Mine is not exactly like others in that my job termination resulted from my declining a relocation due to a corporate reorganization.

Many times, the reason for someone being unemployed is that the recession, or foreign competition, has caused the reorganization or "downsizing" of a company. In most cases this is true, but for some reason an awful lot of people seem to blame the current political administration for their problems. My contention is the same as yours. We are the architects of our own situations.

Your column makes the point that we should be expecting these disruptions in our jobs and careers. I agree. Your point that personal retraining would alleviate much of the pain is right on the mark.

To me, training and education are personal things. I have always tried to keep my knowledge and technology current by reading *IEEE* and other publications, on one occasion taking the IEEE-recommended Heath microprocessor course. Because of my genuine interest in learning about technical and other things (I have a BSEE and an MBA), I find myself in a position of not just looking for any job, but a job I will enjoy and that will challenge me. It may take awhile but I will find the kind of job I want.

My point is the same as yours. Individually, we can prosper if we prepare ourselves and are willing to be mobile in the pursuit of opportunities. Our ancestors were not dummies; they were willing to be mobile to find opportunity. Education and physical mobility will become critical in our economy.

The current recession is not the same as we studied in economic texts. This one is caused not only by a lack of domestic demand; it is also driven by our relative inability to compete in international markets. Textbooks and common sense tell us that our national standard of living must fall to the level of other countries for the U.S.A. to compete. This irresistible economic force is now being felt in almost all corners of our economy, and the recession may have a much longer life than we want to think about.

Manufacturing companies in the U.S.A. have been feeling this pressure for a long time. The disruptions in the U.S. auto industry merely underline the seriousness of the situation. However, we can take hope from the fact that some U.S. manufacturers are competing well internationally. Witness companies like Motorola, with the recent announcement of its cellular telephone marketing venture in Japan. All is not lost.

Some segments of our economy compete well in global markets, and some do not. Corporations and individuals must recognize that the world will not buy poor quality, expensive goods produced by organizations and individuals with short-term, featherbedding and protectionist mentalities.

If we as a nation do not implement reforms, the world markets will force us to. Either way, I will prosper because I am prepared.

I enjoy your column as much as the articles in *73 Magazine.* Thanks for your concise opinions in this season of so much political smoke. 73

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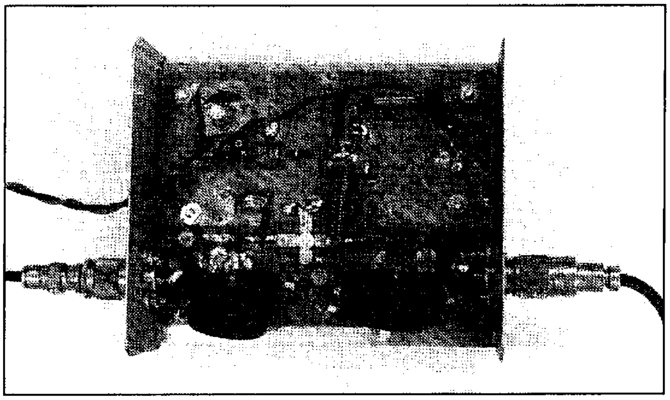
73 Amateur Radio Today

October 1992
Issue #385

TABLE OF CONTENTS

FEATURES



Give your HT a boost . . . see page 20.

REVIEWS

Cover: Easy packet for the Mac. A simple circuit and some software is all it takes. See page 8. Photo by David Cassidy N1GPH.

DEPARTMENTS

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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Audit Bureau of Circulations (ABC) membership applied for.

Contract: The mere possession of this magazine constitutes a binding contract between you and The Team at *73* to spend at least 10% of your operating time working Novices and Techs and making amateur radio more fun for them. No excuses will be tolerated.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

ARRL Guts Packet!

Packet radio, just about the only contribution to technology from amateurs in the last 20 years, has been perceived as a constant threat by the League, so their recent action to virtually end packet operation and experimenting did not surprise many members.

The League was founded as a Morse code message relaying organization back in the days when radio distances on the long wave bands were limited. This evolved into the ARRL National Traffic System (NTS), which has relayed (or lost) millions of inconsequential messages for several generations.

The first serious threat to the NTS came in the early 1950s when RTTY was pioneered, allowing the automatic error-free relaying of messages at about six times the speed of Morse nets. For years the League vigorously opposed any expansion of RTTY beyond 2m . . . a battle that I was intimately involved with and which first brought me up against the clique that was actually running amateur radio . . . for their own profit. That's when I found myself opposed by the smugly arrogant League general manager. This was the same chap the amateurs at the ITU complained about, telling me that they'd had to throw him out of ITU meetings in Geneva because he was drunk and bringing prostitutes to the meetings. Ah, the things our membership dues went for in those days.

Now, is Green bad-fingering the League again? Well, I'm telling the facts as I knew them at the time—nothing that I haven't written before. And I'm only bad-writing the League if you happen to have a prejudice against alcoholics or bimbos, in which case, if you're a Democrat, you are already pre-disturbed. Oh yes, I suppose I might also be inciting CW über alles fundamentalists to a danger of strokes. I'm just telling it like it was.

So what's the latest Newington attack on packet? Well, at the July board meeting they decided to recommend that the FCC ban unattended HF packet operation. As a result the packeteers are screaming like stuck pigs. They're furious with the directors. They're angry with the HQ staff who they claim appointed the ARRL Digital Committee mainly to be the executioners of packet.

In truth, if the FCC does go along with the ARRL's recommendation, that will be the practical end of packet radio, so I can understand the outrage expressed by packeteers. But I think they should give some consideration to the other side of the situation. If packet radio were allowed to continue to develop and grow, providing ever faster automatic message handling, that could well be the end of CW's use for message handling. I think you should keep in mind that packet is primarily a mode being used by younger hams, while CW is used largely by us crusty, arrogant old-timers. The ARRL and its directors have always been devoted primarily to the interests of older hams . . . the same as you find with most ham clubs . . . so this shouldn't be surprising. After all, is there any reason old-timers shouldn't run this crummy hobby the way they want it? And the blunt fact is that most old-timers don't understand packet, with those newfangled computers and all. All you have to do to get an old-timer upset is start trying to explain about packet and his eyes will glaze over and mind snap shut. I know this is true because I'm an old-timer and my eyes are glazed over and my mind snapped firmly shut . . . as any consistent reader of my editorials can testify.

Packet has to do with digital communications or some such nonsense. All I know is that it makes a racket on the band and probably should be moved back to 2m or higher. It doesn't even use tubes, a hand key or even a good old microphone. And it won't be any good in emergencies when we'll need to use a Ford spark coil, a car battery and key it by touching two wires together, so let's get back to fundamentals and stop messing around with microprocessors and other such solid-state garbage.

Of course, if you're reading anything but ham magazines, you know that the world is going digital. Now they're working on a world satellite communications system which will allow us to have a communicator in our shirt pocket which will give us cellular telephone/fax from anywhere. I saw a picture of some guy with his laptop computer sending messages from the Staten Island ferry! So you can see that the commercial outfits will soon be providing all of the communications we can possibly want and we won't need amateur radio any more. Of course the downside of this is that they're going to need a lot more spectrum to provide this service and guess which service has the most almost totally unused microwave frequencies and the least political clout—which is measured in terms of PAC donations to Congressional re-election campaigns—these days?

Yes, packet is kinda slow right now. On our shortwave bands it needs to be developed so it'll have more throughput and a better ability to ignore interference. On the higher frequencies the packet pioneers have been moving traffic at higher and higher speeds, so I can understand the panic this must be generating in Newington to an organization dedicated to CW message handling . . . a Radio Relay League. I'm not sure exactly what a whipper-snapper is, but I am convinced that whipper-snappers should be driven out of the hobby so we old-timers can exchange signal reports and weather information at 10 words per minute.

Do-It-Yourself Education

Millions of people are being thrown out of work as companies, mainly larger ones, downsize. Production workers are replaced by automation, cutting down on blue collar jobs. Other production work is moved to Mexico or Asia, chasing lower wages for low-skilled work. This isn't heartlessness, it's capitalism at work. It's also that most fundamental rule of nature (God, if you like) about the survival of the fittest—natural selection. The smarter are surviving, though smart, in this case, has little to do with IQ, and everything to do with figuring things out, which almost anyone can do—if they think.

Using modem tools to increase productivity without having to work harder or longer—working smarter, we call it—will win out over sweat and grind in the long run. Despite the proliferation of computers, the one place we've lagged seriously behind in productivity has been in white collar work—but we're finally beginning to catch up with the productivity gains manufacturing automation has brought to the production floor. And this means that office workers who work smarter are going to replace those who've refused to learn. And that means unemployment for those too preoccupied with non-work related education.

Scientists, engineers and technicians (the smocks) invent the products; blue collar workers make them; white collar workers market 'em. As any look through the want ads will tell you, we're terribly short on smocks these days. We're up to here in unneeded low-productivity blue collars and we've a growing surplus of the same in white collars. The smarter people are aware of this change and are coping with it by improving their education. A high productivity worker will never be out of work for long.

So how do we learn more and avoid the humility of being unemployed? Do we go back to school, perhaps taking adult courses? And if we do, in what? Or should we go to Barnes and Noble and see what books we can find to help? How about attending conferences and workshops?

It doesn't take a lot of smarts to discover that the money is in the white collar section. Skilled smocks and blue collars are never going to make much because they aren't on the end where the big money lies. The big dough is in sales. It doesn't take a genius to see that perfectly wonderful products are losing the sales battle right and left. So much for the value of the smocks. There's almost no correlation between how good a product is and how well it sells. One only has to look at the music industry for proof of that.

It took me a while to figure this out. I got sucked into going to an engineering college because I was into ham radio when I was in high school. I had a great interest in electronics, radio and audio, so I got conned into engineering. Then along came WWII and four years in the navy. By that time I was smarter, so as soon as I returned to college, I changed from engineering to the management of technology. Good move.

But how does the average Joe cope with the changes going on? One of the best ways is to at least dip one toe into entrepreneuring—to start a small business, even if it's in one's spare time. I've recommended that those of the amateur radio persuasion consider getting involved with security products sales, installation and service. Or TV and computer repairs. Things like that where your supposed knowledge of electronics will give you an edge. Of course if you cheated in getting your ham license and merely memorized Q&As from the ARRL or Dick Bash, you haven't much to start with. If your interest has been in blathering endlessly on the air and not in learning more about the technology, you've been wasting a golden opportunity. You aren't contributing any more to society or yourself than you would as a beer-drinking couch potato watching sitcoms and ball games.

The Publishing Entrepreneur

One way to take advantage of an interest is to start publishing a newsletter and then let it get out of hand. This was what got me hooked. I was having a ball with RTTY back in 1949, but I wanted to learn more and there weren't many information sources. In 1951 I went to work for WXEL in Cleveland as a TV director and by golly, there was a perfectly good mimeograph machine, just waiting for me to start a newsletter. Thus was born *Amateur Radio Frontiers*, my first publication. Thus started a life-long learning experience which has done well for me.

As a publisher you learn to write, edit, set type, lay out pages. You learn about

Continued on page 74

QRX . . .

Number 3 on your Feedback card

Christopher Columbus Award

The Radio Amateurs of Genova, Italy, have organized the Christopher Columbus Award to commemorate the 500th anniversary of the explorer's discovery of the New World. Christopher Columbus was born in Genova. Amateurs earn one point for working Italian stations, three points for working stations in Genova, and five points for working Special Event Stations IQ1CC and IQ2CC, which will be active from Genova and Milan some weekends during the award period: Sept. 1—Dec. 31 1992. Italian amateurs need to make 50 points, Europeans 30 points, and others 10 points. At least one contact each with a station in Genova and one Special Event Station is required. All bands and modes; SWL ok. Send log data, including reports exchanged, by June 1993 to ARI Award Manager, Via Scarlatti 31, 20124 Milano, Italy. The fee is US$6, 10 IRCs, FF35, DM10, 10 Swiss francs, £3.5, or 1,000 Italian lira. *TNX The DX Bulletin, Issue 649, August 7, 1992.*

Ohio and Other Packet SysOps Ban ARRL Traffic

Packet BBS systems operators throughout the state of Ohio, joined by several other SysOps scattered across the country, have placed a ban on all traffic to and from the American Radio Relay League as their way of protesting a decision by the ARRL's Board of Directors to seek regulations that would permit only semi-automatic, rather than fully automatic, packet forwarding on the HF bands. In their letter to Great Lakes Division Director Al Severson AB8P, and disseminated nationwide via packet radio, the SysOps made it clear that the ban on traffic to and from the ARRL headquarters station would remain in effect until the League capitulated and gave its blessing to unattended fully automatic HF packet message forwarding. *TNX Westlink Report, #631, August 14, 1992.*

No-Business Rule Debate Opens, Docket 92-136 Released

The FCC is now actively seeking comments on its proposed revision to Section 97.113 of the amateur radio rules, the so-called "no business" clause that many hams and Commission staffers feel to be counterproductive to the Service.

On July 2nd, The Commission issued its Notice of Proposed Rule Making in P.R. Docket 92-136, to amend its rules regarding permissible amateur communications. The proposal was initiated by several letters and petitions, and is based in large part on an ARRL informal proposal. The Comment deadline is October 1st, with reply comments due December 1st.

If adopted, the new rules would relax restrictions on public-service-related communications—such as for parades, races and fairs—which currently are prohibited. More information on Docket 92-136 appears in the August and September issues of *QST Magazine.* And the Amateur Radio Newsline has announced that it hopes to hold a National Teleconference Radio Network to discuss this matter in a national public forum in early September. *TNX Westlink Report, #630, July 31, 1992.*

ICOM Recall

ICOM has recalled all of its new "P" series 2 meter and 70 cm hand-held transceivers. The company has acknowledged that a problem exists with leaky lithium batteries that have shown up in a couple of units. While the problem does not appear to be widespread, ICOM is not taking any chances. Owners of the "P" series talkies are asked to call ICOM America at (206) 454-7619 for return authorization. All modified handhelds will be covered by an additional one-year factory warranty. *TNX Westlink Report, #631, August 14, 1992.*

FCC: No More SAREX Waivers Needed

Since the beginning of manned amateur radio operation from space, it has been necessary to obtain waivers from the FCC for every astronaut operator of a SAREX station. This was because FCC rule 97.207(a) required the operator of an "amateur radio space station" to hold an Extra class license, and none of the astronauts who have operated from space ever did.

Bowing to requests from the amateur radio community and SAREX planners, the FCC on July 1st revised Section 97.207(a) to authorize any amateur radio license holder to be the control operator of a space station subject to the privileges of the license class held by that operator. The FCC defines a "space station" as being any amateur radio station that is located more than 50 kilometers above the earth's surface and which transmits and receives on frequencies that are allocated specifically to the Amateur Satellite Service.

But with this change come two caveats. First, the FCC chose not to define a "spacecraft" as being a "ship," thus opening the door for virtually any licensed individual with the necessary dollars and initiative to put up a space station of his own. Although this is certainly not likely, it is interesting that this possibility now exists.

Of even greater consequence is the fact that the FCC has mandated that the Volunteer Examination Coordinators rearrange their question pools to include the topic of operating a ham radio from space. In other words, while most radio amateurs will never have the opportunity to operate from such a location as a space shuttle, the FCC wants all hams to know, understand and be tested on this aspect of amateur operations.

The FCC action to amend Section 97.207(a) was based on a petition filed in February by former West Gull ARRL Director and Vice President Jim Haynie WB5JBP. *TNX Newsline; K6DUE; and Westlink Report, #630, July 31, 1992.*

FCC Proposes to Bring Novice License into VEC Testing Program

The FCC has issued a Notice of Proposed Rule Making in P.R. Docket 92-154 that would require Novice class license examinations to be administered by the Volunteer Examiner program, which now administers all other license class examinations. The plan, released on July 23rd, is essentially as proposed by the ARRL and W5YI VECs and described in the April 1992 issue of *QST*, page 63.

The Commission's NPRM notes that codeless Technician class is now the entry-level license of choice over the Novice class, that the FCC is burdened by an application error rate of 9.4 percent for Novices as compared to only 0.8 percent for VE-administered examinations, and that no pass versus fail records are available from Novice examinations, as they are for VE-administered exams.

The FCC believes that bringing Novice exams under the VEC system would be in the public interest. It says that it strongly believes that the VEC-administered amateur system "has demonstrated both its efficiency and its integrity. We conclude that Novice class amateur operator examinations would benefit from those same two virtues."

Opposition to this plan has been primarily a concern that Novice exams would not be as readily available, especially in sparsely populated areas of the country. The League's response was that the explosion in new Technician licensees since the advent of codeless Tech class in April 1991 would indicate that VE examinations are readily available in most areas. The FCC NPRM did not directly address this question, although alluded to it in noting that the Novice is no longer the preponderant first license.

The comment deadline is October 9, 1992. Reply comments must be filed by November 9, 1992. *TNX ARRL, Newsline, and Westlink Report, #631, August 14, 1992.*

Packet on the Mac

Connect with the world without a TNC.

by Dexter Francis KD6CMT

Santa Claus didn't bring me a TNC for Christmas. My anguish was compounded by all the magazine articles which appeared late last year about packet, and low cost TNC-less packet in particular. It seemed that every other page in *73*, *Radio Fun* or *QST* had ads for packet modems and software—all for DOS-based PCs or Amigas.

Although I had spent several years using DOS-based computers before making the switch to the Macintosh, I had no intention or desire to change back just to do packet. So, the only "sensible" option was to figure out how to do packet with my Mac. This was to prove both harder and easier than expected. Fortunately, I have some very talented and supportive friends who are dedicated to both the Macintosh and amateur radio, and were willing to get involved: Ross Wille N6SJD, Aaron Wohl N3LIW and Jim Van Peursem KEØPII. Ross had built the "Poor Man's Packet" project (*73*, August 1991, p. 8). Aaron had been wanting to write some software to act as a TNC for the Macintosh, and Jim had been developing a Macintosh application to do packet.

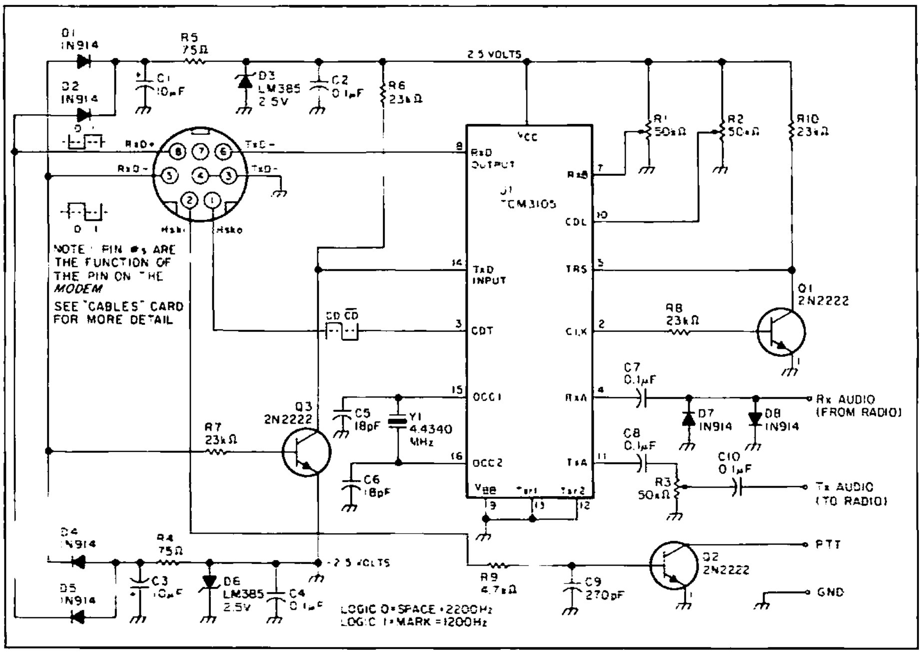


Figure 1. Schematic diagram of the PacketMac Modem.

Overview

Digital communication over a radio (packet, fax) isn't all that different from sending data via telephone. In both cases the digital data is converted into audio tones (modulated), sent from one computer to another, and converted back to digital signals (demodulated). In most cases just two audio tones are used, one representing a "mark" and the other "space." These terms refer back to the days of punched tape and teletype and have corresponding binary "one" and "zero" bit values. All the letters, numbers and symbols of the ASCII character set can be sent in this way. The hardware to do this is called a modem.

Packet-based communication is a bit more complex: It uses a NRZI data encoding scheme, breaks the data up into chunks (packets), addresses and orders those chunks, sends them out over a network and re-assembles the packets back into the original message at the other end. There is a lot of bit-munching going on, which requires some data processing power. Most radio-based packet systems use a Terminal Node Controller (TNC). The TNC's primary function is to act as a traffic cop: addressing, assembling and disassembling the data packets, doing error checking and transferring data bits to and from the modem.

Many TNCs are built around a microprocessor chip and a serial communications controller chip (SCC). One of the most popular SCC chips is the Zilog Z8530/85C30. It has built-in support for what is referred to as High Level Data Link Protocol (HDLC). The Macintosh uses the 8530 to control its serial and AppleTalk ports. In fact, AppleTalk is a packet-based networking environment. Because of this, the Macintosh is an ideal platform for packet radio. The 8530's HDLC mode can be accessed by software, eliminating the need for an external TNC. Many link layer functions can be performed quickly and efficiently by the Mac's built-in SCC hardware. Fortunately, you don't need to know the details of all the layers of the ISO Open Systems Interconnection Reference Model (OSI-RM), HDLC, and AX.25 to do packet. For those who do want to know more, there is an excellent overview of the ISO OSI-RM standard, including the role of HDLC, upon which the CCITT AX.25 packet protocol is based, in Chapter 3 of *Your Gateway to Packet Radio*, by Stan Horzepa WA1LOU, and a full chapter on packet in the *ARRL Handbook*.

The PacketMac Modem

Readers of *73* may be familiar with the Texas Instruments TCM3105 Audio Frequency Shift Keying modem chip, as it was featured in the Poor Man's Packet project last year. Unfortunately, the differences between the Mac I/O ports and most other PCs made powering the Poor Man's Packet circuit impossible without some changes.

PMP took it's power from the PC's parallel

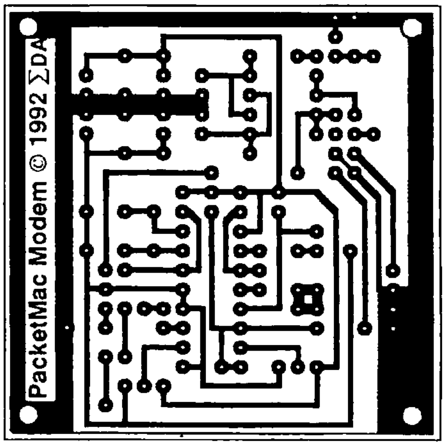


Figure 2. PC board foil pattern for the PacketMac Modem.

port and was configured to run off +5 volts. We could get just +5 and ground off a Mac, but since the Mac serial ports supply positive and negative voltages simultaneously we can build a dual voltage regulator, keep the serial port lines and loads balanced, and use the signals to provide power as well as data. Fortunately, the TCM3105 can be run off a dual voltage supply by hooking Vdd to the most negative power rail (not chassis ground). This is the main difference between the PMP and PMM circuits.

Another consideration is that portable Macs turn off their serial port's data transmit lines to

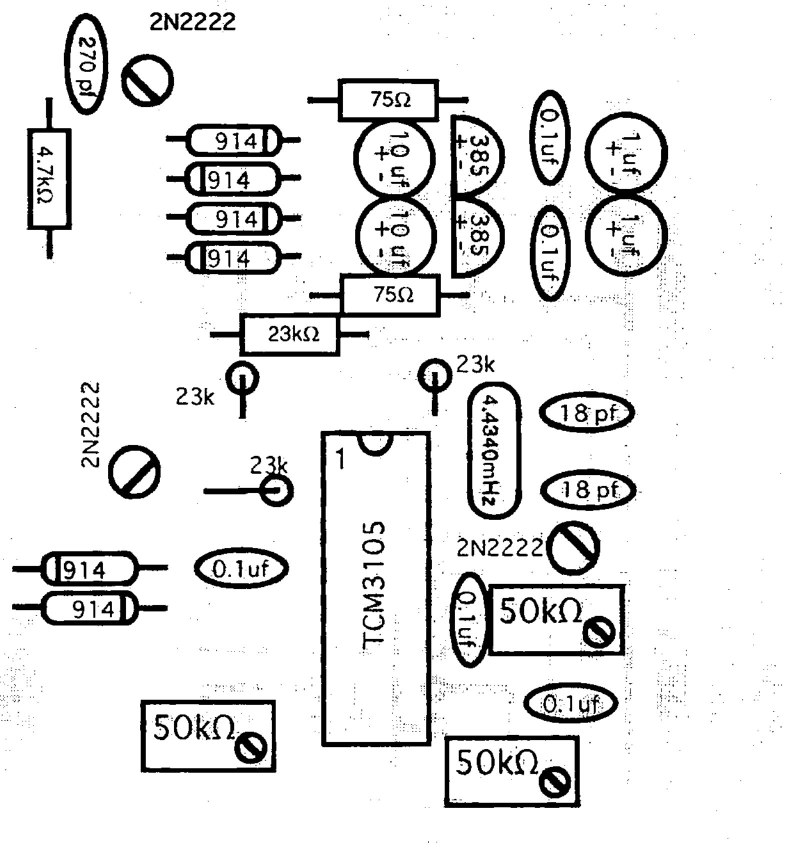
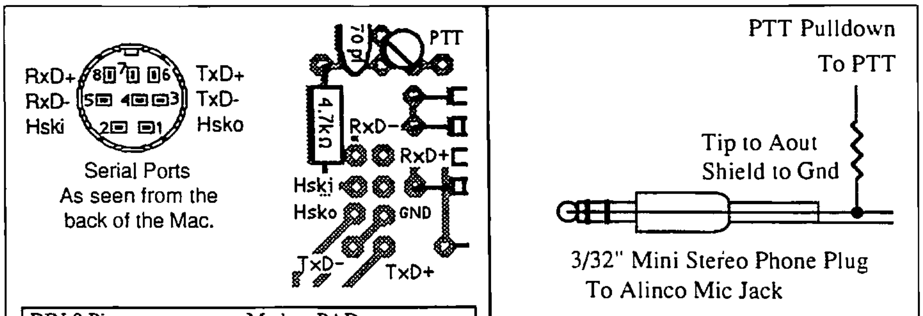


Figure 3. Parts placement.

conserve battery power when data is not being sent. Since the PacketMac Modem gets its power from the serial port data transmit lines, any software has to manage the power as well as handle data transfer.

Many computers communicate with their peripheral devices via RS-232. According to the RS-232 standard, data is sent over two wires, in an unbalanced mode, as a signal which alternates between a positive and negative voltage. Signal levels from +3 to +25 volts are a logic 0, and -3 volts to -25 volts are a logic 1. TTL data is also sent in an unbalanced mode, but with signal levels between 2 and 5 volts considered a logic 1 and signals from 0 to 0.8 volts a logic 0. The Macintosh sends serial data using the RS-422 standard, with the data being sent over two wires in a balanced mode as two alternating signals of opposite polarity (RS-422) or in an unbalanced mode with one line tied to ground (RS-423). A good reference describing the RS-232 standard is: *RS-232 Simplified* by Byron Putnam, Prentice-Hall, 1987. Also you can get a complete copy of the RS-232 and RS-422 standards from the EIA at 2001 Eye St., N.W., Washington D.C. 20006.



DIN 8 Pin <connects to> Modem PAD	
1 - Hsko	Hski (Push to Talk)
2 - Hski	Hsko (Carrier Detect)
3 - TxD -	RxD- (Receive Data)
4 - GND	GND (Mac Data Gnd)
5 - RxD -	TxD- (Transmit Data -)
6 - TxD+	RxD+ (Receive Data +)
7 - Gpi	Not Used
8 - RxD+	TxD+ (Transmit Data +)

Figure 4. Connecting the PacketMac Modem to your radio and the Macintosh. Connections to an Alinco DJ-F1 is shown.

Circuit Changes

The PacketMac Modem gets its power from the Transmit Data Plus (TxD+) and Transmit Data Minus (TxD-) pins of the Mac serial port (see Figure 1). These signals are passed through a diode bridge of four 1N914s which rectifies the AC square wave output from the serial port and charges up the two 10 µF capacitors to about 7 volts above and below chassis ground. Each rail is regulated to plus or minus 2.5 volts with the LM385-Z2.5s These regulators use very little current and stabilize Vss and Vdd to a 5-volt differential. A 0.1 µF capacitor across each rail helps to filter out any transients. A 75-ohm resistor limits the peak current on each rail to about 10 mA.

The rest of the circuit is very similar to Poor Man's Packet, except that the Transmit Data Minus (TxD-) line from the Mac is inverted and used as the digital data input to the modem chip (TXD, pin 14) rather than pin 15 from a DOS PC's printer port. Carrier detect from the modem (CDT, pin 3) is hooked directly to the Mac's input handshake line (Hski) and the PTT switching is performed by the output handshake line (Hsko). Note that the TxD+ and TxD- lines can be confusing: when the serial port is on but not sending data, the polarity of the pin is the opposite of its name. TxD+ goes positive and TxD- goes negative when a data bit is asserted.

Assembly

Start with the socket, jumpers and passive components. Although there is supposedly no internal connection to pin 6, I also trim the #6 lead off the socket. From there, move on to the capacitors and diodes, finishing up with the transistors, crystal, and variable resistors. The board is sized to fit in a box with the mounting holes on 2" centers. See Figures 2 and 3.

Calibration and Testing

There are only three things to adjust in the circuit: Carrier Detect Level, Receive Bias, and Output Level.

Carrier Detect Level: The threshold of the carrier detect circuitry can be adjusted between 398 µV and 4 mV by setting the voltage at pin 10 between 2.5 and 4.25 volts above the -2.5 V rail.

A 400 µV carrier detect level (CDL) may not seem useful in amateur radio, but it is a relative indication of just how good the TCM3105 is at picking out a weak packet signal on a channel with low background noise. I have obtained very good results setting pin 10 to 3.5 volts, which corresponds to a CDL of about 2.5 mV. TI suggests setting the signal level for carrier detect at 1.4 mV, but that is for telephone use. (With the addition of a transistor-switched LED connected to pin 3 you can get a visual indication and adjust the level for the particular channel you are monitoring.) The circuit also presents the CDL signal to the Mac's Input Handshake line, so the software can use it as well.

Receive Bias: The voltage at pin 7 (Receive Bias) must be adjusted to minimize the distortion in the square wave output at pin 8 (Receive Data). The Mac wants a clean square wave with equally spaced rising and falling edge transitions (50% duty cycle). Since we are setting up the

modem to run Bell 202, the midpoint of the mark and space frequencies is 1700 Hz. You can use HyperCard or any other sound-capable application to play a 1700 Hz sine wave out of the Mac's headphone jack and into the modem's audio input. The amplitude of the audio signal should be less than 0.78 volts peak to peak. (Setting the Mac's speaker volume to "1" produces an output of about 0.2 volts, which seems to work just fine.) With the 1700 Hz tone playing, set the voltage at pin 7 to 3.5 and slowly bring it down until the signal at RxD goes low, then increase the voltage at pin 7 slightly, until pin 8 goes high. The receive bias should now be correctly set.

Output Level: Since every radio's audio input requirements are different, you'll have to experiment to get the best modulation on transmit. However, the modem's output level can exceed 2 volts RMS, so be careful not to blow up your microphone input. Start out low and turn the output level up until there is no increase in modulation. One easy way is to monitor the transmitted packets with another radio. Keep slowly increasing the modem's audio output level until there is no further increase in loudness of your transmitted signal. Putting an adjustable potentiometer with a knob on the modem's front panel to adjust the output level is a nice feature if you intend to use the modem with more than one radio.

Tx Pulldown

Many handhelds perform the push-to-talk function with a "pulldown" resistor connected between the microphone audio lead and ground. This resistor is sometimes built into an external microphone. Since it shunts some of the audio output to ground as well as setting the DC bias level for the PTT, some experimentation with its value may be needed (500 ohms seems to work fine for the Alinco).

Typical Packet Radio Configuration

SoftKiss is a control panel that emulates a TNC in KISS mode. It is just like a printer driver—once it is installed and configured, you can't tell it is there. There are some parameters to set, just like with a TNC, in order to conform to the rules for packet transmissions in your area. These parameters can be set with a terminal emulator, or the PacketMac Modem Hypercard stack, or any other application that can send ASCII text to the serial port.

SoftKiss Parameters (default value):

digipeat—ID to digipeat out of a particular serial port.

tx delay—Time for keyup, receiver PLL lock, squelch to break, sync detect. (300000)

dwait—Give priority to digipeated packets (15).

xmit persist—Roll a 1000-sided die and compare the result to 1000 to determine how aggressive SoftKiss is in transmitting into a packet channel. (100)

xmit slottime—How often to decide to transmit. (100)

Precise control of "fast" radios, like the Kantronics D4-10, is obtained by measuring time in microseconds. Most TNCs only give millisecond resolution.

If you have two radios and two PacketMac modems, you can set up a crossband digipeater. When SoftKiss receives a packet on either port it can automatically route it out the other port if the packet requests to be digipeated by the ID of the other port.

You and your friends can share a radio on AppleTalk using NET/Mac. The "attach AppleTalk" command in the autoexec.net file controls access to your radio via AppleTalk.

SoftKiss Theory Of Operation

SoftKiss replaces the standard Apple serial input and output device drivers for the selected port(s). These "fake" drivers emulate a TNC in KISS mode and control SoftKiss. It also installs interrupt vectors to control the SCC hardware. The source code for SoftKiss is about 800K bytes and is available from Aaron Wohl N3LIW or on CompuServe in HamNet lib 9. This may be of interest to other hams working on connections to the SCC hardware.

Planned Enhancements

Bob Finch is doing an interface to Apple's MacTCP driver. This will let you use the commercial and university versions of telnet, ftp, finger, hyper tcp, mail, etc. Aaron is also doing an AppleTalk interface. This will allow you to access printers and AppleShare disks from your local picnic table.

We are also planning on adding features to dynamically modify the parameters which influence the speed and quality of packet transmission and reception and full hardware data carrier detect.

Savant

The only Macintosh applications we know of which communicate with the KISS protocol are NET/Mac and NOS by KA9Q. Both have their roots in the MS-DOS environment. Their user interface is "command line" driven. Our ultimate goal is to develop a complete Macintosh hardware/software package that is powerful and easy to use.

Jim Van Peursem, author of Virtuoso, is developing an application for the PMM and SoftKiss called *Savant*. Like *Virtuoso*, it will be a packet radio communications program with many useful and powerful features: a split window interface, with one panel for information received and one for information that has been sent; and a keyboard buffer window so you can type in long messages and make changes before sending. It will also have a scripting language, so many of the most common tasks can be automated and placed in a menu command. Since the application software will be driving the AX.25 session, it will have much greater control capabilities. The command line interface will be replaced by a full Macintosh graphical user interface. Commands you now need to remember and type to the TNC will be handled automatically by the program. Each channel will have its own window. Reading your mail from the local PBBS will be as simple as selecting a single menu command. For more information on *Virtuoso* or *Savant*, see "New Macintosh Packet Program Released," in the ARRL's *QEX*, May 1992, p. 17; or contact Jim Van Peursem KEØPH directly at 4140 Jay Avenue, Orange City IA 51041; internet—jvp@cpre1.ee.iastate.edu.

PacketMac Modem HyperCard Stack

While testing and calibrating the PacketMac Modem, HyperCard was used to make a stack with built-in sound resources, a loopback test and parameter setting. It includes a full parts layout, and an audio cable hook-up for the Alinco DJ-F1. This was done as a construction aid for members of the Apple Amateur Radio Club, who have built several modems. This stack and PacketMac Modem Kits are available from the author, c/o Sigma Design Associates, 22150 Berkeley Court, Los Altos CA 94024; CompuServe: 70611,1340; internet: Francis4@Apple.com.

The kit, including a 3.5" disk with Soft Kiss, Net/MAC and the Hypercard Stack is $30 plus $2 S&H. You may also send an SASE ($0.58 postage) and an 800K 3.5" disk for the software alone. A drilled and etched board is available for $3.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Getting on the Air with NET/Mac

NET/Mac is a Macintosh port of Phil Karn's KA9Q Internet Protocol Package software. We have been using NET/Mac as our packet application, since it has software support for AX.25, while we continue to develop the AX.25 stack and *Savant*.

NET/Mac is very powerful and very DOS orientated. It supports TCP/IP and FTP as well as AX.25. A number of people have contributed to NET/Mac; Dan Frank, Dewayne Hendricks WA8DZP and Doug Thom N6OYU in particular.

If you want to use NET/Mac to get on the air there are some changes you will have to do to the autoexec.net file. While they aren't very difficult, they are important and may be somewhat confusing if you've never had to do an autoexec file. (You DOS users can breeze through this section.)

What Goes Where

When you receive NET/Mac, there are seven files located in six folders. NET/Mac expects them to be in certain places, and Autoexec.net has information in it to identify you and keep everything running smoothly.

I place it all in a folder named NET. The directory structure looks like this:

```
NET folder
    Net/Mac              (application)
    Autoexec.net         (parameter/configuration file)
    Callbook.log         (callbook log file)

    pub folder
    hosts.net            (listing of host stations)
    ReadMe
    spool folder
        log              (session log file)
    mail folder
        <empty>
        mqueue folder
        sequence.seq
    rqueue folder
        <empty>
    finger folder
        <empty>
```

The Autoexec.net file sets the AX.25 parameters and tells NET/Mac who you are and where to find things. The complete file has lots of comment lines in it. The comments describe the function of the lines, but take up a lot of space. You should also get a current host.net file from your local IP administrator or BBS as soon as possible. An asterisk "*" marks the end of the lines you need to change. The procedure is:

1) Change all instances of callsign to your callsign. (lines 1, 2, and 21)

2) Put in your IP address if you have one. (line 4) (numbers 241-254 are set aside for experimental use)

3) Put in the correct path name to get to the log file. (line 10)

4) Put in your time zone and offset from GMT. (line 17)

5) Put in a beacon message, if needed. (line 21)

6) UN comment the beacon enable line if needed. (line 23)

Note: In some areas, activating the beacon will garner the wrath of the local packet gods. Use with discretion!

```
hostname callsign*
ax25 mycall callsign*
attach asy 1 a ax25 ax0 2048 256 9600
ip addr [44.4.0.246]
route add default ax0
ip ttl 16
tcp mss 216
tcp window 432
tcp irtt 5000
log <path to log file>*
start smtp
start ftp
start echo
start discard
start telnet
start finger
tzone <offset to GMT eg: PDT 8>*
mbox y
beacon set ax0
beacon callsign QST
beacon message "[callsign] Mac TCP/IP
   station. City. State.Country*
beacon interval 1200
#beacon enable*
is_es enable
ip heard on
arp add [44.4.0.0] ax0 QST-0
ax25 digipeat on
ax25 maxframe 1
ax25 paclen 256
ax25 retry 6
ax25 window 4096
ax25 t1 15000
ax25 t2 10000
ax25 t3 180000
ax25 heard on
param ax0 1 60
param ax0 2 100
param ax0 3 10
param ax0 4 3
param ax0 5 0
```

Use TeachText to edit the autoexec.net file. Don't let any line get longer than 40 characters. Punctuation marks, spaces, carriage returns, tabs and other non-text characters should not be used except between the quote marks that mark the beginning and end of the text in the beacon message line.

Definitions

SCC (Serial Communications Controller Chip)—The dual port 85C30 chip that controls the serial port in a Macintosh. The 85C30 programming manual is available free of charge from AMD at 1-800-538-8450.

AX.25—The format for packets that can be sent during unattended transmission. The AX.25 protocol manual is available from the ARRL.

IP/TCP—A popular set of protocols.

NET/Mac—A port of KA9Q's (Phil Karn) tcp/ip implementation by Dwayne Hendrics and Douglas Thom. Available from Compuserve in the HamNet forum lib 9.

Construction Tips and Techniques

One of the most enjoyable aspects of this project was that the Macintosh was used at every step of the design. MacDrawPro was used to lay out the circuit artwork. A LaserWriter was used to print on the TEC-200 film from which the boards were fabricated. Laser printing on TEC-200 was probably the most interesting discovery of the entire process.

The instructions which come with TEC-200 state that you should run the film through a copy machine. I tried that with very mixed results. Since laser printers are essentially half of a xerographic copy machine, I thought I'd try printing the artwork with a LaserWriter.

Laser printers transfer a mixture of carbon dust and plastic (toner) from their print drum onto the paper and then carefully run it through a "fuser" roller which heats the toner up and melts it. The melting point of TEC-200 is high enough that the toner can be transferred to it and fused without the TEC-200 being damaged. This leaves a positive image of the artwork on the TEC-200 which can then be transferred to a PC blank with a hot iron, much like iron-on T-shirt transfers. Since the fused toner is water resistant, it also resists water-based etching agents. If you lay out and print the PC artwork as though viewed from the component side (as in Figure 5), the image is automatically reversed when you iron it onto the foil side of the board blank. *[Ed. Note: With a normal PC board foil pattern you will have to do an intermediate step using a transparency or another sheet of TEC-200 film to flip the PC board foil pattern when using TEC-200 film process. Figure 5 is already inverted for direct use with TEC-200 film.]*

It helps to clean the PC board well (with a mildly abrasive kitchen cleanser and a scuffing pad) and wipe down the TEC-200 with an oil-free, alcohol-based window or white board cleaning spray before running it through the printer. Use the single sheet/envelope slot and try not to bend or squeeze the film after printing. The fused toner is brittle and will crack and flake off if you aren't careful.

A 0.50 millimeter rapidograph pen with a water resistant ink cartridge works very well for touch-ups and produces boards that look almost as good as commercially done photo etch. Size the pads to 0.040" o.d. and set the line width to two points (about 0.030"). Lines wider than two points may develop "cracks" down the middle due to toner migration, but you can touch these areas up with an ink pen or resist pen after you've transferred the layout to the PCB blank. Use the rulers and grid lock options in MacDraw to keep your pads and traces aligned. I lay out the pads first, generally on 0.10" centers, and then move the pads in front of the traces. This is important: If the trace lines are on top of the pads, the end of the trace lines will obscure the open area in the middle of the pads. We want the pad centers etched away so they will be easy to drill. (The etched-out depressions in the pad centers are a natural drill-centering feature.) Some gentle brushing or probing with a pencil or toothpick during etching will break the bubbles which tend to form there. This will help assure the copper is completely etched away in the centers of the pads. I also cut the TEC-200 down to an 8-1/2" x 5-1/2" size and run it through the feed slot with the 5-1/2" direction as the width.

Connecting

Plug the PacketMac Modem into your Mac's modem port. Open Softkiss by double-clicking on it's icon and set the modem port for Kiss Mode TNC. If you want to run off the printer port you can set it for Kiss Mode TNC, but you will also have to change the attach line in the autoexec.net file to read:

attach asy 1 b ax25 ax0 2048 256 1200

This is because the Mac's printer port is port b and the modem port is port **a**. Configure Softkiss before launching Net/Mac.

A complete operation manual for NOS, the DOS version, is available on CompuServe in Ham Library 9 as NOSGDE.TXT. The latest version of Net/Mac (2.3.3) also has online help and an appendix with information on setting up the autoexec.net file.

When you run Net/Mac and invoke the connect command, a window will open up that will be named by the text string you define. For example:

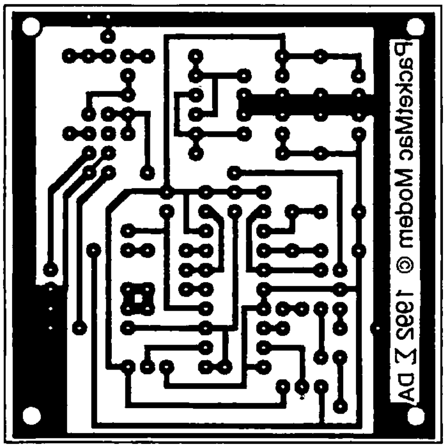


Figure 5. Inverted PC board foil pattern for use with TEC-200 film only. This pattern will eliminate the transparency inversion step required in the TEC-200 procedure. Do not use this foil pattern if using standard photographic methods (use Figure 2 instead).

c ax0 n0ary-1 (connect <interface> <callsign> [digipeaters]) connects me to NØARY-1,

Continued on page 85

73 Review

by Jeffrey Sloman N1EWO

The AEA IsoLoop™ 10-30

A big antenna in a small package.

Advanced Electronic Applications, Inc.
P.O. Box C2160
2006 196th St. S.W.
Lynnwood WA 98036-0918
Telephone: (206) 774-5554
Price Class: $349

Can a two-inch aluminum band a little over three feet in diameter work as anything more than a dummy load on HF? The textbooks say it can, and AEA has proven it with the new IsoLoop 10-30. Loop antennas have been in use from the beginning of radio, but practical loops for use at HF frequencies face several engineering problems and real world limitations that AEA has managed to overcome.

The IsoLoop is a 43-inch aluminum loop, with a center portion—made of UV resistant, injection molded high density polyethylene—shaped roughly like a dumbbell. In the center of the dumbbell section is a hole designed to accept a mast up to two inches in diameter, along with stainless steel hardware for clamping the antenna in place. A stainless steel hose clamp is provided for mounting the antenna radially, for use from, say, a balcony railing. The stainless U-bolt is also needed, and it is a minor inconvenience that the antenna housing must be disassembled—three hex bolts with nylon-retained aircraft nuts—to remove it from its default center position.

In the larger end of the dumbbell is a 10,000-volt split-stator capacitor. The two ends of the irradiated aluminum band that makes up the loop are welded to the two halves of the capacitor's stator. This one-piece design is very rugged, its only downside being the need to deform the loop to fit it into a UPS-shippable box. It takes some work to get the loop round again after unpacking it, though it need not be perfectly round to operate perfectly. If you are like me you will want the loop to be round for aesthetic reasons. Also in this end of the housing is a precision stepper motor and gear train for remote control of the capacitor's tuning.

On the smaller end of the dumbbell is a one-turn electrostatically shielded loop made of coaxial cable. This shielded coupling loop matches the extremely low impedance—less than 1/10 ohm—of the radiating loop to the 50-ohm feedline. It also acts as a balun which isolates the feedline from the antenna—the effect that gives the IsoLoop its name. The input to the antenna is through a supplied right angle PL-259 adapter which helps to route the coax at a 90 degree angle to the antenna. The antenna must be mounted with the SO-239 connector facing down, along with the drain hole also located on this side.

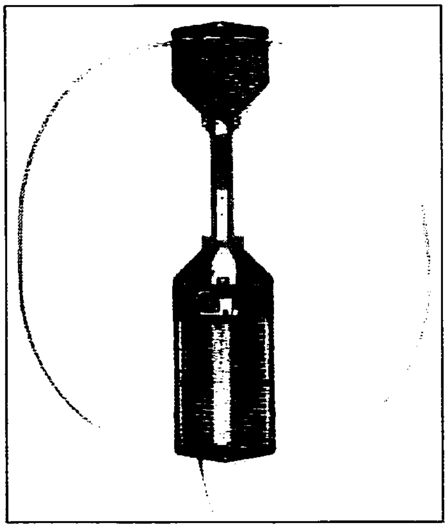


Photo A. The dumbbell shaped housing of the IsoLoop contains a 10,000-volt split-stator capacitor, a stepper motor, and a one-turn loop for impedance matching.

Also in the package are the LC-2 controller—for tuning the antenna—and its 12-volt wall mount transformer power supply. The LC-2 is a small beige box with two thumbwheel controls, two push-button switches, and four LEDs. The left-side control—marked SENS—adjusts the sensitivity of the LED audio level indicators; I'll explain these later. The control on the right—marked SPEED—adjusts the pulse rate of the signal sent to the stepper motor located in the antenna, which adjusts the tuning speed. The push-buttons control the direction of the capacitor's travel. On the back of the LC-2 are jacks for power (standard coaxial), the stepper motor (5-pin DIN), and the audio in/out (1/8 phone).

New and Improved

This IsoLoop is the new and improved version of the original IsoLoop 14-30 antenna introduced in 1990. *[Ed. Note: See the review of the original antenna in the September 1990 issue of* 73, *p. 10.]* The original had an operating range of only 14-30 MHz; AEA has added 4 MHz to the low end to cover the 30 meter band. The original used aluminum tubing and required assembly. This design was prone to loss from bad connections of the tubing sections to each other and the capacitor. The older model used a belt drive for reduction from the stepper motor to the capacitor, while the improved version uses a gear-driven reduction unit.

How It Works

The IsoLoop has a wonderfully elegant design. It is a simple tuned LC circuit, with the aluminum band providing the L and the custom designed capacitor providing the C. The connection to the antenna is made through mutually coupled air core inductors. The one-turn electrostatically shielded loop is inductively coupled to the resonating loop. Undoubtedly, many of you have already recognized this as the same design common to antennas used by BCB (BroadCast Band) DX enthusiasts. The difference between this antenna and the IsoLoop is twofold. The IsoLoop is designed for much higher frequencies and so is actually quite efficient in spite of its small size. Its efficiency ranges from about 70% on 20m to as high as about 95% on 10m.

The second principle difference is the capacitor in the IsoLoop. Designed for transmitting, it is capable of about 150W. Its split stator design avoids the moving contacts required by conventional designs. The IsoLoop achieves the ideal of placing the tuner at the antenna. This antenna tuner does what its name says: tunes the antenna! Because the IsoLoop is actually resonant, it easily outperforms practical dipoles mounted at the same height. There is some misunderstanding concerning the ability of a small antenna to perform well in the HF bands. The fact is, what is important is resonance—and this antenna resonates.

Installing the IsoLoop

Unpacking the IsoLoop is easy; it is packed in a box slightly smaller than the IsoLoop's diameter. Two small cardboard boxes contain the LC-2 controller, its power supply, and male-to-male 1/8-inch phone patch cord. The antenna slides from the box with little effort, and its 18-pound weight is not too difficult for one person to handle. Out of the box the antenna is set up for axial mounting, parallel to the earth. In this configuration

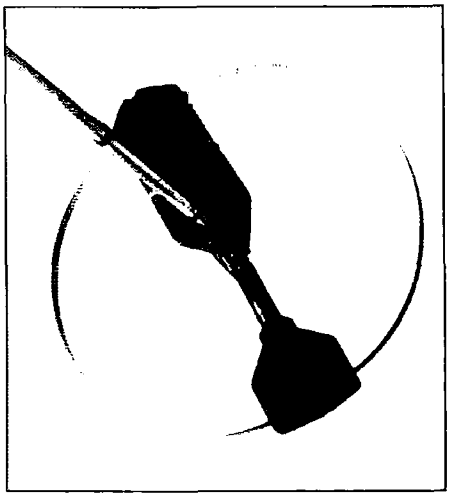


Photo B. The IsoLoop's default mounting position is parallel to the earth and provides an omnidirectional pattern.

the antenna's radiation pattern is omnidirectional. A bidirectional pattern is also possible using the alternate mounting position, which places the antenna perpendicular to the earth. Since the antenna is especially good for restricted space installations—like apartment buildings—using the alternate (radial) mounting position may prove useful for installing the antenna on high-rise balconies and out of windows.

When choosing a mounting location, keep in mind that the IsoLoop will only perform properly when mounted at least four feet from large—especially metallic—objects. This includes four feet from the ground, which, while it sounds like a relatively poor location, is not necessarily that bad. The IsoLoop is a loop antenna and not a dipole. It does not suffer from the problems of a dipole located closer than a half wavelength to the earth. While four feet off the ground is clearly not Ideal, the IsoLoop's radiation angle is about 37 degrees, while only a quarter wave from the earth. This low radiation angle insures better DX performance by delivering most of the transmitter's power at an angle that will take advantage of ionospheric propagation. Remember: The angle of incidence equals the angle of reflection.

While the IsoLoop was being tested here, it spent most of its time on a four-foot aluminum stepladder in the middle of the second-floor ham shack. Even in this makeshift installation the antenna performs exceptionally. In any case, while the IsoLoop is more forgiving than other antenna designs, it still works better mounted higher in the air. Its relatively small size allows for mounting with standard TV mast and hardware, and its low profile is unlikely to cause too much consternation among the neighbors.

Once the mounting location is chosen, and the antenna physically mounted, the feedline and control cable must be routed back to the transceiver. Supplied with the antenna is a right-angle adapter for the SO-239 input to the antenna. This allows the coax to be routed at 90 degrees to the antenna which minimizes induced currents in the feedline. A small piece of Coax Seal™ is included to protect the antenna connection. Fifty feet of control cable comes installed on the antenna. If this is not enough, AEA can supply 50-foot extension cables. The 5-pin DIN connector used on the control cable is a common type, and the cable itself is a shielded 5-conductor cable, so building one yourself of arbitrary length should be no problem.

Once the cables are routed back to the shack, the coax is connected to the transceiver and the control cable is connected to the 5-pin DIN connector on the back of the LC-2 control box. The LC-2 will also need its power supply connection. The supplied patch cord is used to connect the rig's speaker output to the input on the back of the unit, and an external speaker is plugged into the adjacent output. These connections are only neces-

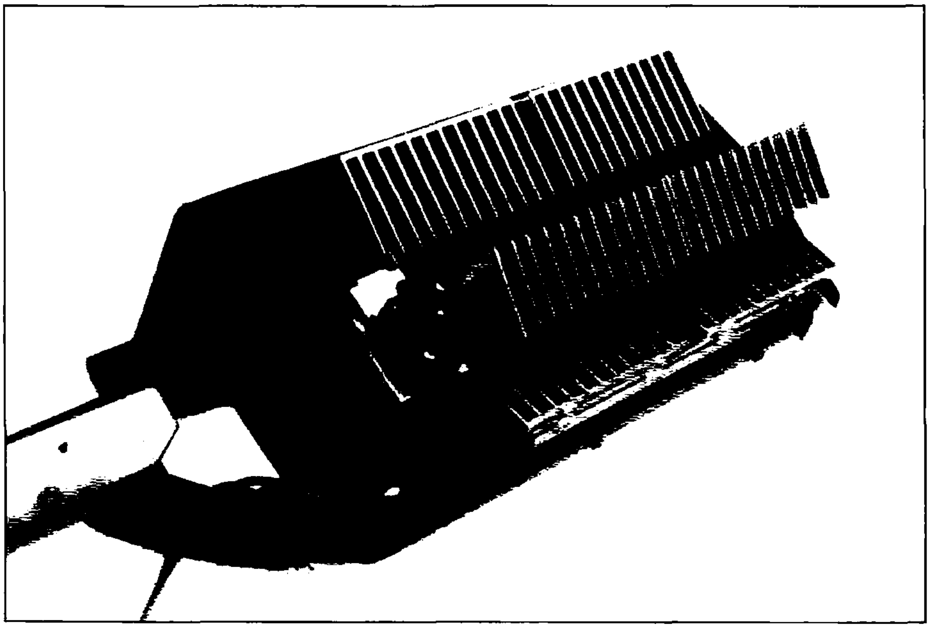


Photo C. The special split-stator tuning capacitor built into the IsoLoop is capable of handling up to 150 watts. The capacitor is remotely tuned via a motorized gear-driven reduction unit.

sary if you intend to use the LC-2's tuning indicator—which is especially useful for older radios (see the description below). Once all these connections are made, the antenna is ready for use.

Using the IsoLoop

Without some understanding of how to use the IsoLoop, you could spend several frustrating hours getting the antenna to work. Because of the extremely narrow passband of the IsoLoop, it is important to understand how to tune the IsoLoop and/or to develop a technique of your own.

Tuning the loop is accomplished with the LC-2 controller. The capacitor is driven by the stepper motor through a 30:1 gear reduction drive. This allows very fine adjustments of the capacitor, which are necessary because of the very tight resonance of the loop. The speed control adjusts the pulse rate of the signal to the stepper motor with the slowest setting providing the tiny adjustments necessary to fine-tune the SWR, while the highest speed will move the capacitor's rotor through its entire rotation in about 15 seconds. Tuning works like this:

1. Remove any antenna tuners from the feedline, and if the rig has a built-in tuner—turn it off.

2. With the speed control in the fastest position, press either direction button until the noise in the receiver peaks. This will happen quite suddenly, and the peak is very small. You will probably pass through the peak, but let go of the button as soon as you notice it. It will sound like a burst of noise. [Note: If you have an older rig with a mechanical S-meter, and you have connected—what AEA calls—the audio-visual LEDs, you can use these to observe the peak. Adjust the sensitivity control until just the left-most LED glows, and the first of the two center LEDs flicker. As you rotate the capacitor, you can watch for the peak—on the LEDs—as well as listen for it. If you have a modem rig with an electronic VU meter—one that supplements the S-meter, showing the audio level—you can use this instead of the LC-2's LEDs.]

3. Adjust the speed control to about middle speed. Press the other direction button, which will bring the capacitor back the other way, toward the peak you passed. You will not have to wait long. You will probably pass through the peak in the other direction. Alternate the directions—adjusting the speed control downward if necessary—until you feel you have peaked the noise (or signal) as best you can.

4. Adjust the speed control to its slowest position and, using an SWR meter, repeat the procedure above for the lowest reading. A correctly installed IsoLoop should tune down to about 1.5:1 or less from 10-30 MHz. Retuning will be necessary every 10-100 kHz, the bandwidth increasing with frequency. Keep in mind:

•The capacitor has no stop, it rotates freely and there is no absolute up and down related to the directional controls.

•The peak is very small; you will have to practice to make the antenna work.

•Turn off your antenna tuner! You will try forever to get the IsoLoop tuned with no success if it is on.

•Be sure to mount the antenna at least four feet from large objects if at all possible.

As you can see, the tuning procedure—while not necessarily complex—is specific. Once you get the hang of the procedure you will probably find yourself using faster and faster speeds for all but the final touch-up for SWR. You will also become better at hearing the peak. This antenna becomes better as you do. Some of you may remember a similar procedure—at least in feel—from the days before automatic antenna tuners.

Performance

I was interested in the IsoLoop because of my limited space and restrictions against outside antennas. Connected to a Kenwood TS-450S, the antenna performed brilliantly. I had the opportunity to work some band openings on 10m—and got universally excellent signal reports. Running about 25W, I was able to work the East Coast from my Indiana QTH. I had a hard time convincing some of the stations I contacted that I was using the IsoLoop and 25W—but I was. Keep in mind, too, that the antenna was indoors on an aluminum stepladder. The IsoLoop consistently outperformed a 50-foot longwire using the automatic antenna tuner in the Kenwood. I was able to monitor packet QSO on 30m, and CW and SSB QSO on 20, that were not even audible on the longwire.

Who Should Use an IsoLoop?

The IsoLoop is extremely flexible. It is the perfect limited space HF antenna, useful for apartment dwellers, those with restrictive covenants, and those with aesthetically sensitive neighbors. It is also useful for mobile applications, such as mobile homes, emergency command vehicles, and boats—but with its 15 pound weight, I would be hesitant to put it on a car (though I have heard it's been done). Even if you don't have space restrictions, the IsoLoop works better than wire antennas, is easy to install and use, and might just be the ideal antenna to supplement your tribander.

Conclusion

The IsoLoop is one of those products that is a pleasure to use. it is an elegant application of a traditional design with modem engineering. Its performance is exemplary; it will not disappoint you.

IsoLoop 10-30 Specifications

Frequency coverage	10 to 30 MHz (continuous)
Nominal impedance	50 ohms
Connector	SO-239
Power handling	150W
VWSR	1.5:1 or less across operating range
Diameter	43"
Shipping weight	25 pounds, may be shipped UPS

A 2 Meter FET Amplifier for Your Handheld

Build this simple, inexpensive FET amplifier.

by John Cunningham AA4AW

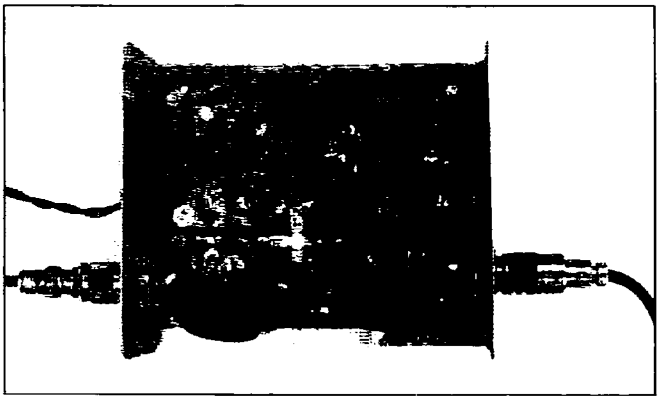


Photo. The 2 meter FET amplifier. Photo by John Cunningham AA4AW.

Field-effect transistors (FETs) have numerous advantages over bipolar transistors. FETs have more gain, greater efficiency, and greater tolerance for being overloaded than bipolar transistors. They are far less likely to be destroyed as a result of thermal runaway or high SWR. They can be operated over a greater voltage range and over a greater power range—both input and output power. The drawbacks to them are that they cost more and are more likely to go into oscillation as a result of the increased gain of the circuit using them. Furthermore, they are more prone to static destruction than bipolar transistors, and great care must be taken in handling them until they are soldered on the circuit board.

When I wanted more power for my handheld, I looked for a circuit that was relatively simple to build, could be built with available parts, and could operate at 13 volts. The result of several hours of research was this FET amplifier.

I chose Motorola's MRF 137 for the project because at 2 meters it will amplify inputs from a range of less than 100 milliwatts to 5 watts—the range of any handheld. The transistor is also capable of being used on 220 and 440 MHz, as well as on HF frequencies down to 2 MHz. It will operate well with 12 volts on the drain; and if more voltage is available, it can handle 30 volts comfortably. The transistor may be obtained from Motorola by calling (602) 244-6900. [Persons living in the southeast United States may call (800) 368-8163.] The MRF137 costs about $30. The MRF137 is also available for $24 plus shipping from RF Parts at (800) 737-2787 or (619) 744-0700.

Construction

I used a Radio Shack 276-1499 circuit board for this project, but any board that is approximately 3" x 5" may be used. *[Ed. Note: An etched and drilled PC board is also available (see the Parts List)].* The board needs to have foil on both sides to aid in heat dissipation for the transistor. Only one side of the board needs to be etched. I drew the pattern with a felt pencil which left the copper that was to be etched exposed. The unetched copper was further protected by duct tape. I then used Radio Shack 276-1435 etchant, following the instructions printed on the etchant bottle. All the components are located and soldered on one side of the board, similar to a ground-plane configuration—the difference being that some etching is done and some components are soldered to etched portions of the card. This design makes for improved grounding and ease of troubleshooting.

Since the ground will be in two separate halves once the RF path is etched, you must drill holes in the board to provide a proper ground path. Two holes need to be drilled on either side of the source because grounding is most critical here. One hole each should be drilled at the ground side of trimmers C2 and C4 and on the ground on the output side of T2. See Figures 2 and 4. Once the holes are drilled, small jumpers should be installed in the holes and soldered to both sides of the foil. The resultant jumpers can then be honed to make them even with the rest of the foil. Be careful not to hone too much or some of the foil may be ground away.

When the circuit board is etched and the ground jumpers installed between the foils, components can be soldered into place. See Figure 4 for the component layout, which is critical at 2 meters.

To prepare T1 and T2, 17-1/2 inches of RG-58/u coax needs to be cut. Cut a half-inch of the outer insulation off each end. Next, cut the outer conductor and the inner shield to expose a quarter-inch of the center conductor. See Figure 3. The cable then needs to be coiled four loops—each loop being slightly more than one inch in diameter. You can use tape to hold the loops in place until the cable is tied to the circuit board using tie wraps. The ends of the coax can then be soldered into place.

In addition, you will need two more small lengths of coax between T1 and T2 and the input

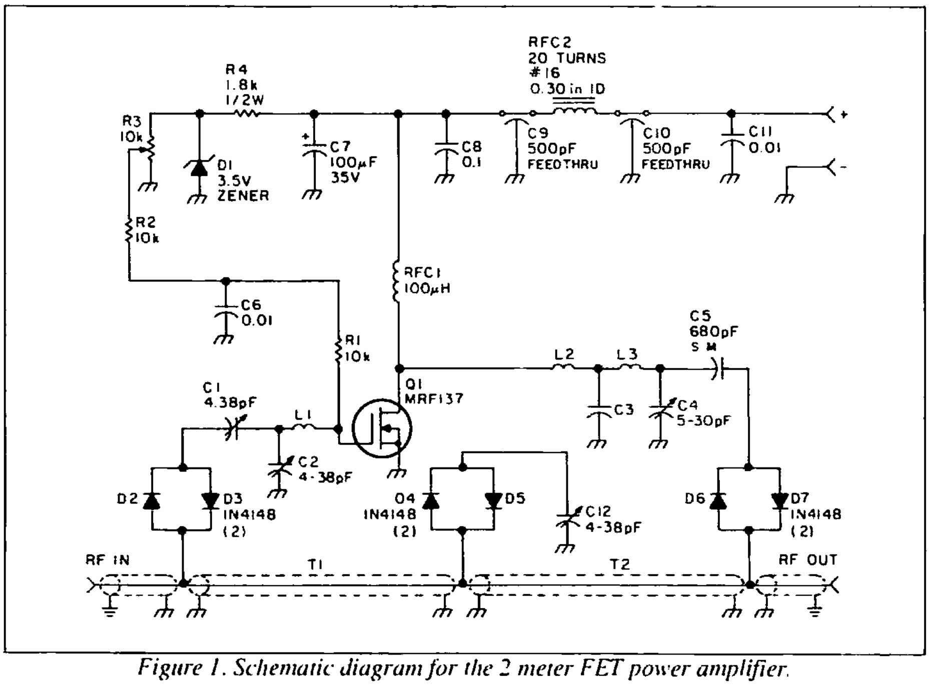


Figure 1. Schematic diagram for the 2 meter FET power amplifier.

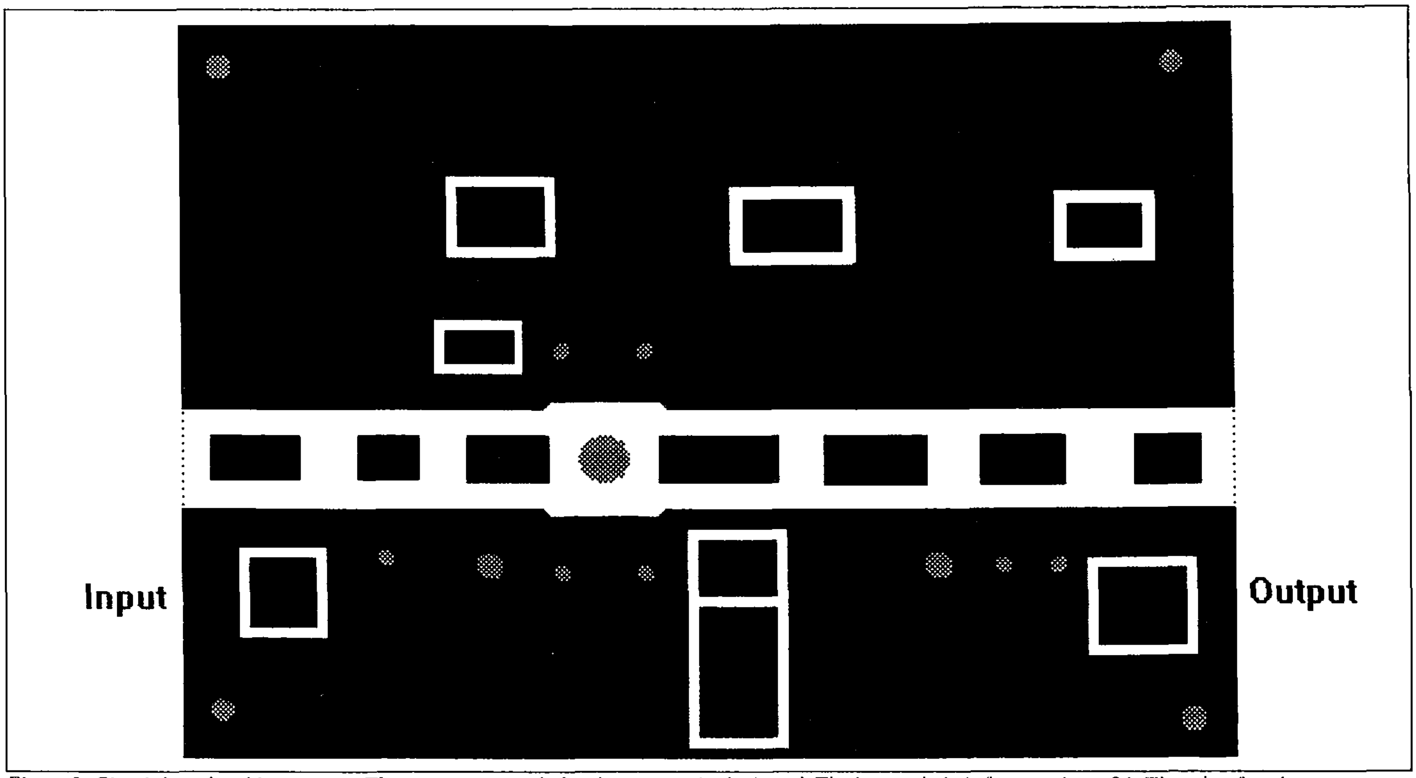


Figure 2. Circuit board etching pattern. The gray areas are holes that are cut in the board. The largest hole is for transistor Q1. The other four larger ones are for the mounting hardware, and the rest of the circular holes are for solder jumpers between the two foil layers. The square holes are for the ties that hold T1 and T2 in place. Take care that the input foil and the output foil do not go all the way to the end of the board or it might short against the walls of the mounting box once the unit is assembled.

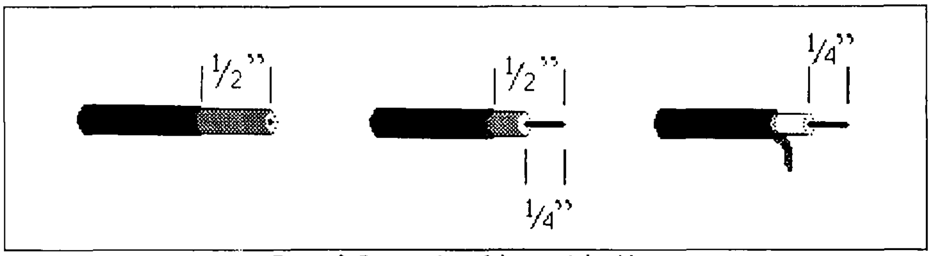


Figure 3. Preparation of the coaxial cables.

and output connectors. Cut two pieces of coax two inches long. Prepare the ends of them the same way T1 and T2 were prepared.

The transistor should be placed on the board last. Great care must be taken in handling a field-effect transistor to avoid a static discharge which can destroy the device. The soldering iron, workbench, and circuit board should be grounded before the transistor is removed from its protective package. A ground strap worn around the wrist would also be helpful. If possible, the transistor should be picked up only by its two drain leads. Once soldered into place, the danger of static buildup is minimized.

A heat sink needs to be bolted to the transistor, using a flat washer. Thermal heat sink compound, such as Radio Shack 276-1372, must be placed between the transistor and the heat sink. Only a small amount of the compound need be used as the compound will squeeze out once the bolt is tightened.

When the components are soldered into place, you need to make resistance checks before applying power to the amplifier. If you check the resistance from the voltage input to the ground and find it high, it is safe to apply power. You can also check to see that there is zero resistance between the positive voltage and the drain of the transistor. The resistance between the drain and the gate should be at least 21k ohms. If these conditions are not met, recheck the components and their layout.

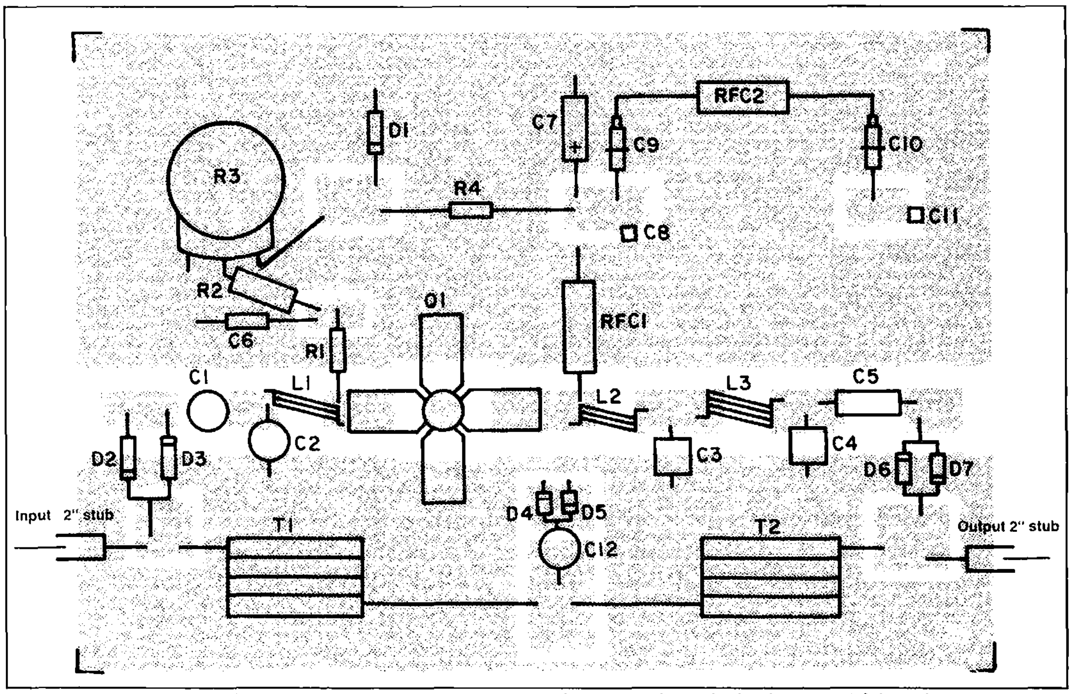


Figure 4. Parts placement. Mount components directly to the etched side of the PC board.

After the resistance checks are made, you will need to align the amplifier. To do this, you will need a 2 meter transceiver, power supply, dummy load, and some kind of power indicator. A spectrum analyzer would be ideal, but a relative power/SWR meter will work when attached to a dummy load.

First, apply 12 volts to the amplifier. Be sure 12 volts are reaching the drain. Also check the voltage on the gate, which should not be higher than 2.5 volts. If it is higher, adjust R3 to lower it. Any voltage higher than that may cause the amplifier to go into oscillation. Touch the transistor. If it is too hot to touch, the amplifier is oscillating and the voltage on the gate needs to be lowered by adjusting R3. If the gate voltage is lower than 2 volts, adjust R3 to raise it.

With the amplifier still on, apply 1 watt from the 2 meter rig on an unused 2 meter frequency (use a dummy load). See if there is any indication of power in the output of the amplifier. At this point it is normal if there is none. Adjust C1 for maximum power indication. There still may not be any power going through the amp. If that is the case, adjust C2, C4, C12, and R3 until you see power on the output. Keep adjusting these components until maximum power is obtained without oscillation.

If you have a 28-volt power supply, increase the voltage to that amount. The increased voltage may cause the amplifier to go into oscillation. Adjust R3 until the oscillation stops; then adjust the trimmers again. Adjust R3 and the trimmers until maximum power is obtained.

Measure the current coming from the power supply. The MRF137 has an efficiency of approximately 50 percent. Therefore, 50 watts coming from the power supply should yield an RF output of about 25 watts. At 28 volts the current coming from the power supply should be approximately 2 amps. At 12 volts the current should be slightly more than 1.5 amps.

The amplifier is designed to allow the received signal to pass through when not transmitting. Check to see that an RF signal will pass through to get to the transceiver.

How It Works

When in the receive mode, diodes D2 through D5 will not conduct because the signal level is too low. T1 and T2 do not attenuate the signal enough to be noticeable, and the center conductor of the coax allows the RF signal to pass straight through to the receiver. When transmitter power is applied, diodes D2 and D3 are forward biased and conduct power to the gate of Q1. Q1 amplifies the signal and carries it to diodes D6 and D7, causing them to conduct also. A small portion of the amplified signal goes through T2 to diodes D4 and D5, causing them to conduct. Trimmer capacitor C12 tunes T1 and T2 to an electrical quarter wavelength, thus effectively shorting one end of the transformers and making them appear as open circuits to the signal. Thus, it is almost impossible for output power to get back to the input through T1 and T2. This circuit is simpler and more reliable than using relays to switch from transmit to receive.

Coils L1—in combination with C1 and C2—match the transistor to a 50-ohm input while L2, L3, C3, C4, and C5 match the transistor to a 50-ohm output. Bias is provided by R1 through R4, and bias voltage is kept constant by zener diode Z1. Bias voltage is adjusted by R3.

Results

At 100 milliwatts (the low power output on many handhelds), the amplifier puts out 2.5 watts with 13 volts on its drain. Remember that FCC regulations and sound radio practice require that minimum power be used in radio transmissions.

This design gives 25 wans out when fed with 1 watt at 2 meters and with 28 volts on the drain. With 13 volts on the drain, the output is 9 watts—as good as can be achieved with most popular bipolar transistors under similar conditions. Furthermore, at 13 volts the transistor should easily outlast its owner since it is almost immune to damage from high VSWR and thermal runaway.

If more than 1 watt can be fed into the amplifier, there will be more power at the output. At 13 volts, 3 watts in will yield 20 watts out. Increasing the input to 5 watts will yield only slightly more power. Nothing more will be gained by going beyond 5 wans input, and too much input will cause harmonics to be radiated. By increasing the power supply voltage to 28 volts, a whopping 50 watts output can be achieved with only 2 watts input! Again, putting more power in at this point will not yield much more output power.

The amplifier will work well as a mobile unit with no more voltage than the 14 volts a car supplies. If you have a 12- to 24-volt DC-to-DC converter, so much the better.

My thanks to Will Payne N4YWK for his encouragement and technical assistance—without his help the project might never have worked. Also, thanks to my XYL, Carolyn KC4NBE, who edited the manuscript.

Parts List

C1, C2, C12	4-38 pF trimmer
C3	56 pF
C4	5-30 pF trimmer
C5	680 pF silver mica
C6	0.01 µF disc ceramic
C7	100 µF 35-volt
C8	0.1 µF chip
C9, C10	500 pF feedthrough
C11	0.01 µF chip
D1	3.5-volt zener
D2, D3, D4, D5	1N4148 high speed switching diodes, Radio Shack 276-1122 or equivalent
L1	2 turns 0.30" i.d. #16 enamel closewound
L2	1-1/4 turn 0.2" i.d. #16 enamel closewound
L3	2 turns 0.30" i.d. #16 enamel closewound
Q1	Motorola MRF 137 or equivalent *
R1, R2	10k 1/4-watt
R3	10k variable
R4	1.8k 1.2-watt
RFC 1	Radio Shack 273-102 100 µH RF choke
RFC 2	20 turns 0.30" i.d. #16 enamel closewound
T1, T2	17-1/2" RG-58/u coax coiled four loops

An etched and drilled PC board is available for $6 + $1.50 shipping/handling per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

* The Motorola MRF137 is also available for $24 + shipping from RF Parts, Box 700, San Marcos CA 92060. Phone: (800) 737-2787 or (619) 744-0700.

Number 7 on your Feedback card

73 Review

by Larry R. Antonuk WB9RRT

Electronic Distributors Co.
325 Mill St. N.E.
Vienna VA 22180
Telephone: (703) 938-8105
Fax: (703) 938-6911
Price Class: $385.95

The DAIWA DP-830 Digital SWR and Power Meter

Simultaneously measure power and SWR from 1.8 to 525 MHz.

There's always been a surefire way to tell a hard-core ham. He's the one with the expensive wattmeter. A quality wattmeter, with all those elements and the case and everything, can easily cost more than a cheap HF rig. You can be sure that if someone shells out that kind of money for a piece of test equipment, he's really into ham radio.

Fortunately, the people at DAIWA have made owning a quality wattmeter a little easier for the the rest of us non-hard-core types. The DP-800 series of wattmeters sport top-of-the-line features, accuracy equal to the industry standard, and a price that won't blow the ham budget. The DP-810 covers 1.8 to 150 MHz, at 0.1 to 1500W, and has a list price of $265.95. The DP-820 covers 140 to 525 MHz, at 0.01 to 150W, and lists for $295.95. The deluxe DP-830 covers both of the above bands, and throws in a four-time-zone clock, for $385.95. All three units read SWR from 1:1.0 to 1:5.0, and measure PEP as well as average power. The units have a power reading accuracy of 7% of full scale for average readings, and 12% for PEP readings. Readings are displayed on a 2-1/2 digit LCD display. Six AA batteries power the meters, and a power lead is included if you want to power the unit with your own 8-to-15-volt supply.

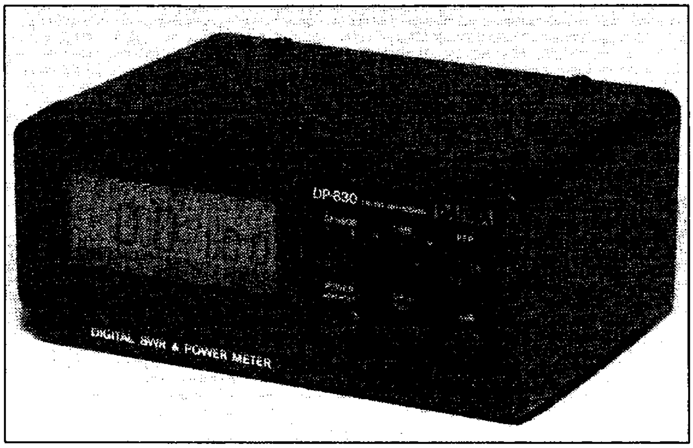


Photo A. Front view of the DP-830 digital SWR and power meter.

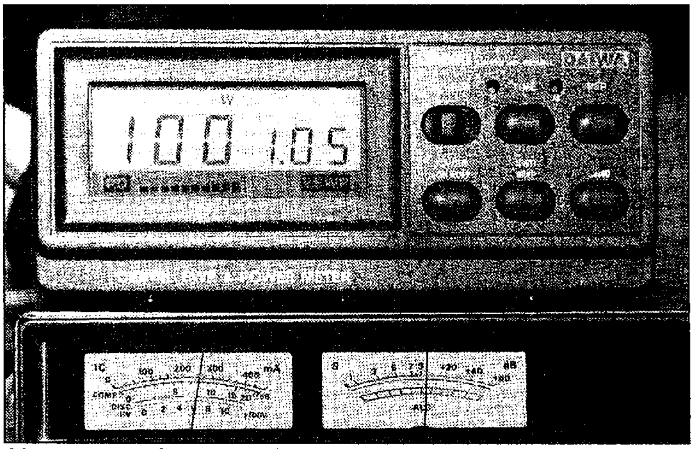


Photo B. The DP-830 happily sitting on a transceiver. Note the simultaneous display of power and SWR. Relative power is also shown by the bar graph.

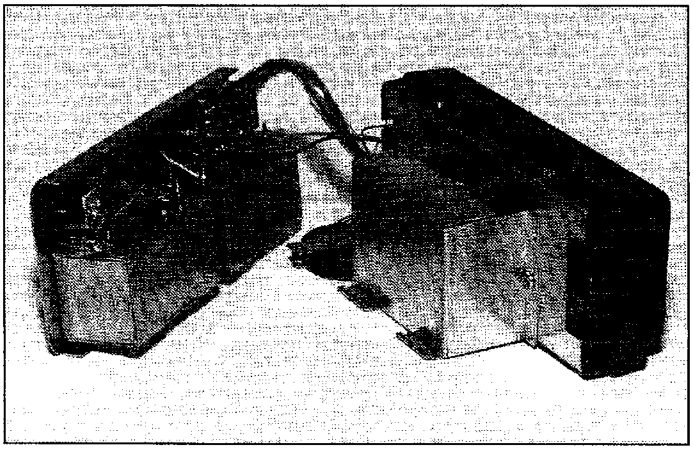


Photo C. Interior view of the DP-830, showing the housings containing the two sensing units, and the battery housing attached to the back of the main board.

Wide Frequency Coverage

The classic problem with wattmeter design concerns the need to use the unit on a wide range of frequencies. This is certainly the case for the radio amateur—even an entry-level ham may find the need for power measurements at 28 MHz and 146 MHz, quite a range in itself. As the frequency increases, the capacitance and inductance inherent in the sampling circuits changes, causing inaccurate readings. This has traditionally been solved in one of two ways. The first method is simply to limit the design frequency of the instrument. As an example, most wattmeters found in the average ham shack are designed for the HF bands, say 2 MHz to 30 MHz. These will be relatively accurate over most of the range, and tend to be a little less than accurate up near 10 meters. The second method involves changeable sensing elements. These elements, often called "slugs," are built for a small band of frequencies. As the frequency of interest is changed, so is the slug, ensuring a correct reading (as long as the correct element is used).

Features

The DP-830 takes somewhat of a combination approach to the problem. It uses two separate sensing elements, one for 1.8 to 150 MHz and one for 140 to 525 MHz. The proper connections to each element are made via the back panel—two "N" connectors for UHF, and two "SO-239" connectors for the HF. Both transmitters can be left hooked up at all times, and a front panel switch selects one element or the other.

Other front panel functions include the TIME selector—tapping this button selects one of four different time zones. Set one to local, one to GMT, one to the buddy you have that sked with, and the last one to . . . ??? Whatever, it's there if you need it. A nice feature of the time function occurs when the unit is hooked up to an external supply. When left in the TIME mode, the unit kicks in to read power as soon as the transmitter is keyed, then switches back to time mode. (One of those

features you're glad that somebody thought of . . .) A BAR GRAPH switch toggles the 15-segment bar graph on and off. An SWR BEEP function causes the unit to beep in different ways, depending on the level of the SWR. Musically-inclined hams will find a chart in the instruction sheet that relates the different SWR levels to the musical notes that will be produced. For example, an SWR of 1.30 equates to three "D sharps" followed by one "E flat." While most of us will use this function only as an ongoing alarm system—anything other than one beep means trouble—this is an extremely valuable feature for sight-impaired operators, or anyone who wants to rapidly tune up an antenna for minimum SWR without having to see the meter. The front panel controls are rounded out with a PEP/AVERAGE switch, a POWER switch, and recessed time set controls.

The physical construction of this unit leaves nothing to be desired. Both RF sensing units are enclosed in metal housings, mounted inside a stylish metal cabinet. Simply picking up the DP-830 is enough to convince you that this is a quality unit. The unit looks good enough to warrant a permanent spot on the operating shelf, but is tough enough to be used mobile, or in a service environment.

Operation

Operation of the DP-830 was very straightforward. Simply pop in the six AA batteries (yes, they're included) hook up the transmitter(s) to the appropriate connectors, set the clock, and you're in business. The unit was well within specification when compared to a lab standard wattmeter. In actual ham shack use the unit performed flawlessly. The bar graph meter was very responsive, and would be quite useful for tune-up operations. The ability to see both forward power and SWR simultaneously is a real plus, although a reflected power reading is not available. The unit autoranges, and perhaps the only feature missing is a "range hold" switch. For those of us who operate right around 150W (the point where the unit switches *from* W to kW) it would prevent the unit from flopping between 149W and 0.151 kW, and the corresponding change in the bar graph.

The only weak point to the DP-830 concerns the documentation, written both in Japanese and broken English. Considering all of the starving technical writers around, it's amazing that DAIWA didn't hire one to give their manual the once-over before it hit the press. The operation of the DP-830 is mostly self-explanatory, so this is more a matter of mild amusement than serious concern. (However, at one point after changing the batteries my unit "woke up" with no display! Nothing I could think of corrected the problem, so as a last resort I read the instructions. Luckily, I found this passage: "Please push the RESET switch when the any informations are not dis-

Continued on page 63

A New Look at Loop Antennas

Adding regeneration to ferrite-core and open-wire box loops.

by Ken Cornell W2IMB

Anyone who has used a properly operating regenerative preamplifier can appreciate the tremendous gain, sensitivity and selectivity that it provides their receiver for weak signal detection. Why not apply this principle to a loop antenna?

Due to years of experimental efforts, I had several types of ferrite core and open wire box type loops available. I decided to rework my favorite ferrite core loop to provide regeneration. I wired up a simple regenerative preamplifier on a small piece of perf board and wound some new coils to provide a source tap. The preamplifier circuit is shown in Figure 1. The loop assembly is shown in Figure 2 and it is offered as a suggested design.

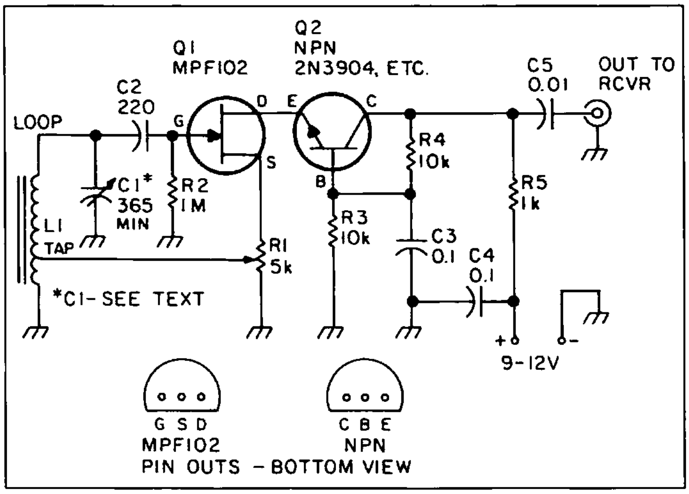


Figure 1. Preamplifier circuit.

I mounted the regeneration control potentiometer with the back shell pressed against the board, using double-sided tape (RS #64-2343). It is not practical to mount the tuning capacitor on the circuit board support so I mounted it on the base disc and connected it to the coil (L1) using a length of RG-59/U coax cable with the shield going to the ground end of the coil and the inner conductor to the gate end.

On the threshold of oscillation, the tuning is extremely sharp and a vernier dial should be used for C1. Another scheme would be to place a 10 to 15 pF variable capacitor across C1, set at half capacity, and use this for fine tuning as well.

Part values are as shown. Capacitors are disc type, 35V. Resistors are 1/8 or 1/4 watt. Potentiometer R1 should have a linear taper.

Of course, L1 and C1 should be a resonant circuit covering the desired frequency range. The number of turns required can be an experimental endeavor, depending on the ferrite core permeability and size. Most ferrite cores have a fairly high permeability (800 or more), therefore operation above 10 MHz is impractical since there would be too few turns on the coil to obtain a reasonable L/C ratio. Above 10 MHz a box wire loop antenna should be used instead of the ferrite rod/coil combination.

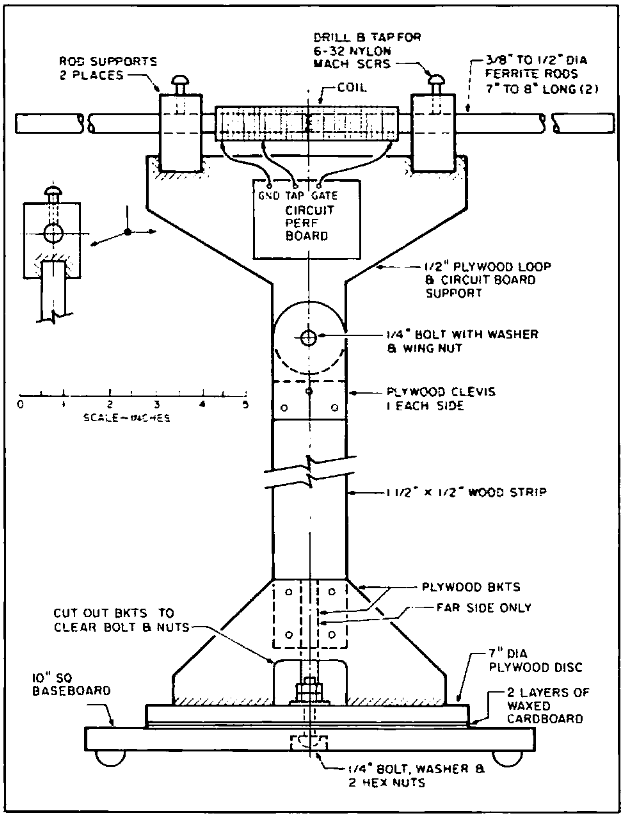


Figure 2. Loop assembly.

Construction

I used 1/2" diameter rods with a permeability of 2,000. I wound my coils on a 5/8" diameter form. Using a two-gang BC band variable capacitor for C1 with the stators in parallel for 160 meters, I wound 45 turns of #28 enameled magnet wire with the source tap at nine turns up from the ground end. The best tap for all coils is about 20% to 25% of the total number of turns: for 80 meters, 25 turns; and for 40 meters, 11 turns, with the wire space at 1/8" between turns.

If you follow the construction shown in Figure 2, I suggest that the two rod supports be clamped together and then drilled for the rods. Then place these on the rods and tape the junction of the two rods to insure proper alignment. Finally, cement the supports to the circuit board support.

The height of the rods over the base should permit swinging the rods to a vertical position without interfering with the base board.

The two layers of waxed cardboard sandwiched between the disc and the base board will allow smooth rotation. The center line bolt with its nuts should be just tight enough to allow for this.

To change coils, loosen the two nylon set screws and withdraw the rods. I used short lengths of flexible wire attached to mini-alligator clips to connect the coil to the circuit board.

In operation, it takes a little practice to become familiar with the features. Place your receiver and preamplifier in operational condition and advance the arm of R1 towards the source end. The circuit should go into oscillation. Turn back the arm and at some midpoint you should hear a weak "plop," then tune in the desired signal and slowly advance the arm back to the source end. Just before the circuit goes back into oscillation, the signal will peak up tremendously and at this point fine tuning is required.

Another much simpler design that I tried out with equal success is shown in Figure 3. In this case the rod is in a fixed position and the whole unit has to be rotated. The unit could be mounted on a camera tripod "pan head" to provide horizontal-to-vertical scanning.

Ferrite core loop antennas are not limited to the use of only one or two rods; in fact,

Continued on page 78

73 Review

by Mark T. Schmidt WB9EGA

The Kantronics KPC-3

Kantronics Company, Inc.
1202 E. 23rd Street
Lawrence KS 66046
Telephone: (913) 842-7745
Price Class: $120

Full-featured packet in a compact package.

Kantronics has been in the business almost from the beginning of packet radio and is still going strong. Their KPC-2 has been around for some time now and the software has been updated numerous times. In the beginning there was the basic VHF/HF TNC with Digi. Since then they have added a BBS, KA-Node (their version of node) capabilities, WEFAX and remote control.

Their latest entry is the KPC-2's little brother, the KPC-3. Although the only thing little about it is its size.

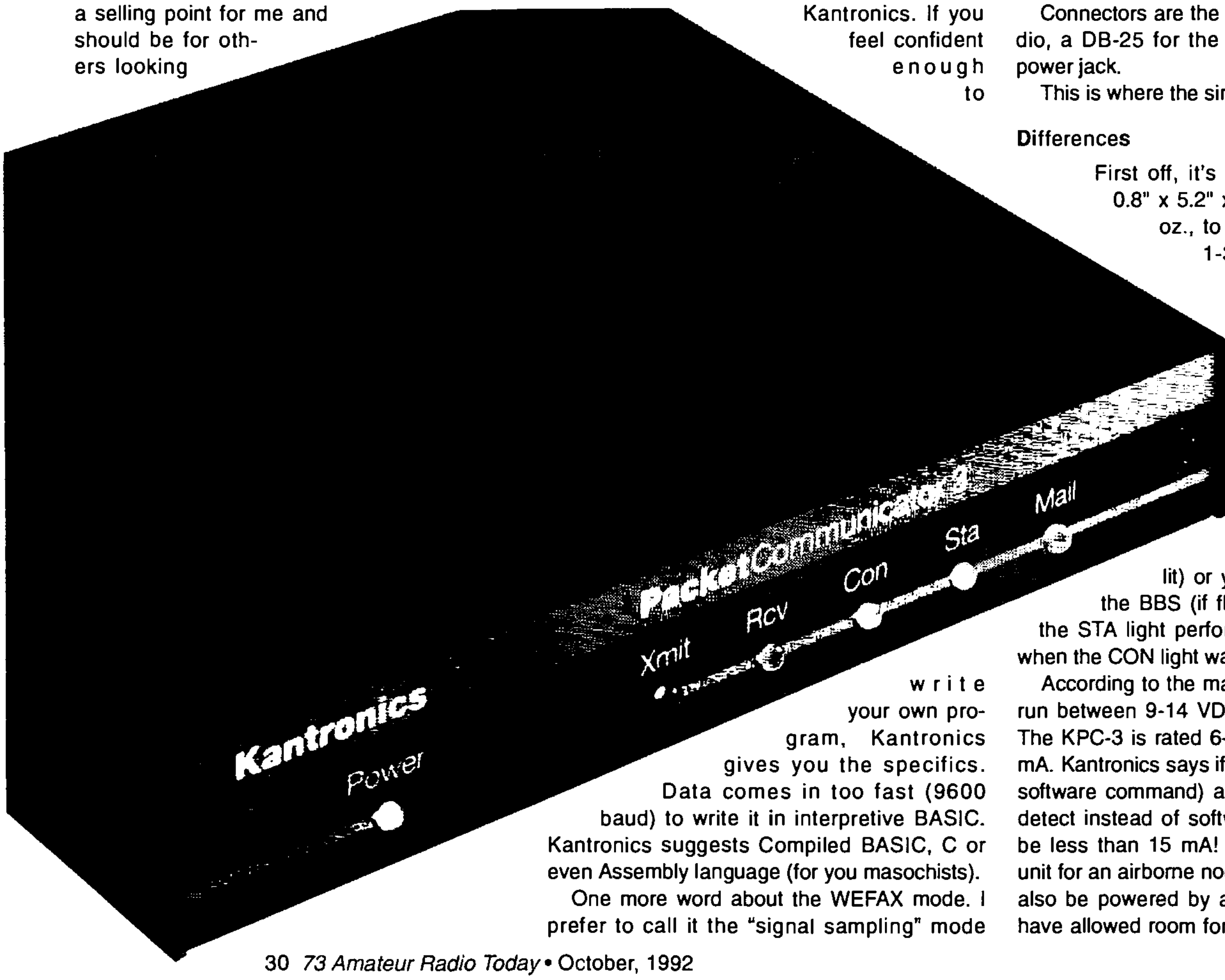
Similarities

Features like the PBBS, KA-Node, Host mode, KISS mode, WEFAX and remote access are still there and operate identically to the KPC-2.

The KA-Node has always been a selling point for me and should be for others looking for a node. Unlike other nodes, you don't need to burn another EPROM or buy any updates. All parameters can be set by the user, even remotely.

The addition of remote control operation is a plus. No more special trips to the Digi site to set parameters. You have to be careful not to paint yourself into a corner. Hint: Don't turn EQUALIZE off unless you are certain you can turn it back on again. An unscheduled trip to a mountaintop taught me that one.

I've never had the chance to operate WEFAX. Most amateurs would probably never have a reason to get their own weather map, except for the novelty; however, I could see small Emergency Operation Centers (EOCs) that might want their own current copy during a hurricane alert. PC software is not included but is available from Kantronics. If you feel confident enough to write your own program, Kantronics gives you the specifics. Data comes in too fast (9600 baud) to write it in interpretive BASIC. Kantronics suggests Compiled BASIC, C or even Assembly language (for you masochists).



One more word about the WEFAX mode. I prefer to call it the "signal sampling" mode since all it really does is sample the incoming signal, at intervals set by you, and send a raw bit stream of 1's and 0's based on mark and space tones. I'm able to decode RTTY signals with a simple BASIC program. Although Kantronics says the center frequency is 1700 Hz (where everything higher than that comes out as a "1" and anything lower is a "0"), I've been able to copy 2125/2975 tones on VHF-FM. Experiment with this mode and see if you can come up with a program to decode ASCII and maybe even CW.

Many units use DIP switches to set the RS-232 baud rate, turn the LEDs on and off, etc. I have always liked the idea of software switches instead of hardware DIP switches. It just makes the unit look cleaner and software switches don't get dirty. The KPC-3 retains the software switches.

Connectors are the same: a DB-9 for the radio, a DB-25 for the RS-232 and a 2.1 mm power jack.

This is where the similarities end.

Differences

First off, it's smaller. Much smaller. 0.8" x 5.2" x 5.2", weighing in at 11 oz., to be exact; compared to 1-3/4" x 6" x 8", at 2-1/4 lbs., for the KPC-2. That's one-quarter the size and one-third the weight!

In addition to the POWER, XMIT, RCV, CON and STA LEDs, they've added a MAIL light to indicate someone is connected to your PBBS (if constantly lit) or you have unread mail in the BBS (if flashing). On the KPC-2, the STA light performed this extra function when the CON light was off (not connected).

According to the manuals, the KPC-2 would run between 9-14 VDC at less than 250 mA. The KPC-3 is rated 6-25 VDC at less than 40 mA. Kantronics says if you turn off the LEDs (a software command) and use hardware carrier detect instead of software detect, current will be less than 15 mA! Sounds like the perfect unit for an airborne node for 24V aircraft. It can also be powered by a 9V battery, which they have allowed room for inside. It's nice to know

you have something to fall back on in an emergency, but don't expect it to last for days. This battery is disconnected when you plug in the power on the back. The 9V battery connector is NOT installed and is NOT included loose. In the manual, they do give Radio Shack as a source and directions on where to solder it to the board.

Parameters are no longer PERMed into an EEPROM. A lithium battery now backs up a SRAM (including the mailbox) and keeps the clock going.

The AFSK output level on the KPC-2 could be changed by moving a jumper between a HI (21 mV) and a LOW (4.5 mV) position. Other levels can be had by changing a resistor. In the KPC-3, two ranges are available and are set by a jumper: 2 mV to 60 mV, or 140 mV to 4V. Adjustments within the range are done with a pot, though you must take off the cover to get to it.

Kantronics has designed in the option of installing a real-time clock. They say it's only used when the unit is first powered up. You can go ahead and put one in if you want, but now that I can control everything remotely, including resetting the time, I don't think it's really necessary.

The KPC-2 has HF capability but without some kind of tuning indicator, it's a chore. HF capability on the KPC-3 is gone but probably won't be missed anyway since many more are used on VHF than on HF. Although HBAUD can be set down to 300, the 1200/2200 Hz tones remain the same. There is a simple mod to change it to 1300/2100 Hz if needed.

The early KPC-2s were delivered with 16K expandable to 32K. After a while, 32K became the standard. But after configuring 5-node channels it leaves only 3K for a BBS. Memory in the KPC-3 comes with 32K but can be increased to 128K or 512K. Kantronics acknowledges that there is yet no supplier of 512K x 8 memory chips, but when there is, the "3" is ready. This should free up many computers dedicated solely as BBS's.

Ever want some kind of quick reference sheet to tell you in one line what a command does? Well, they don't have a printed sheet—they've gone one step further and put it online. At the command prompt, type a "?" or "HELP," followed by the parameter. Example: "?MCON" told me, "If on, allows monitoring to continue while connected;" and "HELP AXDELAY" said, "Time delay between PTT and radio data out (10 msec)". If you still must have hard copy, turn on your printer and type "?HELP." This will print out all commands and their one-line explanation.

A 2.5-minute Watchdog timer is standard. Although I've never had a TNC lock up on me since version 1.0, it's better to be on the safe side. It can be disabled by installing a jumper.

Some hand-held radios combine the PTT and MIC signals onto one line. Cables had to be wired to separate the signals and send them down two different lines. In the KPC-2 and KPC-3 there is an isolation modification you can make to have the TNC take the PTT signal off the MIC line for you. In the KPC-2, this involves cutting a jumper wire and soldering a new jumper to a different position. Somewhat permanent. The KPC-3 has the same sort of thing but makes it a little more flexible by providing jumper posts and a plastic connector. It just slips on and off. If you use one of these HTs exclusively, this may be something worth looking into since it simplifies cable wiring. But if you jump back and forth between different radios, this may not be very convenient. I prefer to have a cable made for each radio I have. The single resistor and capacitor needed for isolation fit easily inside the DB-9 hood.

The serial port on the KPC-2 could be configured to provide normal RS-232 signal levels or TTL levels for computers that need it, like the Commodore C-64, C-128 or VIC-20. The KPC-3 provides RS-232 levels only.

The Manual

My KPC-2 came with an "Installation Manual," "Operations Manual" and "Commands Manual" in an 8-1/2" x 11" format. They actually covered the KAM, KPC-4, KPC-2400 and KPC-1 along with the KPC-2. It took a binder to hold it all. If you take out the parts that pertain only to the KPC-2 and make it smaller (about 6-3/4" x 8-1/5" would be good) for easier storage, you would have the KPC-3's "Reference Manual." Portable operators will find it more convenient. Beginners to packet radio might find the manual (or anybody's manual, for that matter) somewhat intimidating. After all, there are 130+ commands. How are you supposed to know which ones are important now and which ones you can play with later? For you they've printed a "Getting Started" booklet. It shows 23 basic commands to get you up and running and cable wiring diagrams for eight of the more common radios.

Just about any terminal software will work with this TNC but if you have none, they've included one for you. "Pacterm" comes on a 5-1/4" disk and is easy to use. It's not the most elaborate software, but it works. It appears it was designed for the KAM since there are more options available than you need. All instructions are in the "Getting Started" booklet.

Suggestions

It's hard to find fault with this unit, but if I had to pick something I would choose the lack of a power supply. One came with the KPC-2 but not with the KPC-3. I know it can operate on the internal 9V battery, but not forever. This may be a minor inconvenience for many users, but I had to pick something. Also, it would be nice if they included the 9V battery connector, too.

Accessories

The KPC-3 comes with the two manuals, the Pacterm program, a DB-9 connector with metalized hood, five-conductor shielded cable, a mini-plug cable and a 2.1mm power plug.

Likely Users

Who should take a close look at the KPC-3?

Portable users: The smaller size and lower power requirements are a definite advantage. With a handful of 9V batteries you could operate for quite some time.

Node operators: Increased memory gives you more channels. I've always been somewhat reluctant about using a full-blown KPC-2 as a node when I wasn't using all the features it had to offer, like HF. Remote operation capability will save you trips to the site for any parameter changes. Also, the KPC-3's price is about $50 lower than the KPC-2. This makes leaving it on a mountaintop a little more palatable.

BBS operators: For many applications, this might be all you need. Dedicated BBS computers can be put to use elsewhere. If you kept your station up because you needed your own PBBS, you might not now. Your local node can serve as everyone's PBBS.

Emergency services: Search and Rescue organizations, like the Civil Air Patrol, often operate from field locations on auxiliary power. The less you have to transport the better. Don't forget the instant high capacity BBS.

Conclusion

Don't let the KPC-3's small size fool you. On VHF, it will do everything the KPC-2 does. Dollar for dollar and feature for feature, I don't think you'll find a better TNC. I think Kantronics has another winner here. 73

Baby Loopy

A half-wave, inductively-loaded loop.

by Dean Frazier NH6XK

Did you ever experiment with a half-wave loop in the horizontal plane, loaded at the 1/4 and 3/4 points? They're easy to make, and give you 3 to 6 dB gain and about 20 dB side rejection by reducing the current in the sides. This results in greater current across the antenna along a line from the side opposite the feed point, through the feed point. They are ideal for beaming in a fixed direction, and on the higher frequencies they can be made so small that rotatability is entirely feasible. They mount easily on a rooftop. I've worked with them from 10 through 40 meters and without exception have had very good results, compared with my R5 vertical and 414-foot longwire. With this background in mind, my purpose in this article is to show you how to design and set up your own "Baby Loopy."

Note: The loop is physically smaller than it would be as a half-wave antenna because a portion of the half wave's wire is used as loading coils. The loop is physically, not electrically, smaller. See Figure 1.

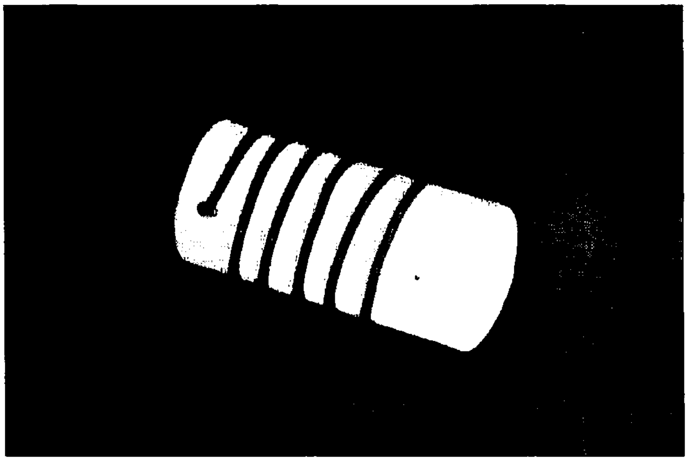


Photo A. Winding the coil on the PVC pipe form.

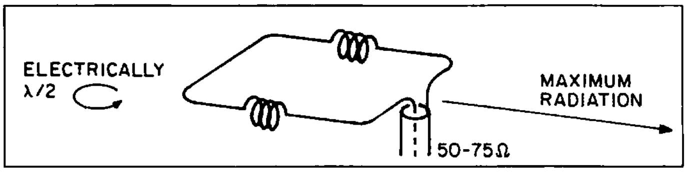


Figure 1. Diagram of the baby loop antenna.

Construction

To figure the amount of wire (feet) needed for the half-wave loop, calculate as follows:

$$\frac{\lambda}{2} = \frac{1005}{2(f\ \text{MHZ})}$$

Example: $\frac{\lambda}{2}$ loop for 40 meters (7.2 MHz):

$$\frac{\lambda}{2} = \frac{1005}{2\ (7.2)} = 69.79\ \text{feet}$$

The 1/4 point (e.g., the center of the first coil) will be, measured from the feedpoint, 69.79/4 = 17.45 feet, and the 3/4 point (the center of the other coil, again, as measured from the feedpoint in the same direction) will be 3/4 x 69.79 = 52.34 feet. The center of the second coil should come out at 17.45 feet from the feedpoint, as measured in the opposite sense as the first coil was measured. See Figure 2.

Now, to achieve the gain and side rejection, we need to introduce about 360 ohms of inductive loading by coiling the wire at the 1/4 and 3/4 points on the wire:

$X_L = 2\pi fL$ where X_L = inductive reactance (ohms),
$\pi = 3.14$ and f = frequency, (MHz)
$360\Omega = 2\ \pi(7.2)L$
$L = 360/2\ \pi(7.2) = 7.96\ \mu H$

Recall that for an air-wound coil, the following formula shows the connection between the coil diameter, "d" (in inches); the number of coil turns, "n;" the length of coil when wound, "ℓ" (in inches); and the inductance, "L," in microhenries:

$$L = \frac{d^2\ n^2}{18d + 40\ell}$$

Solving this equation for "n," the number of turns, yields:

$$n = \frac{\sqrt{L\ (18d + 40\ell)}}{d}$$

If, for example, we happen to have two-inch PVC pipe on hand on which to wind the coils, we calculate the number of turns required, "n," by estimating an appropriate coil length, "l":

l = 4 inches estimated

If, again for example, after some trial and error, we decide on a length of coil of 3-5/8 inch, we find about 19 turns of wire will give the desired inductance:

$$n = \frac{\sqrt{7.96\ [18\ (2) + 40\ (3.625)]}}{2} =$$

$$18.98 \approx 19\ \text{turns}$$

$$(3\ ^5/_8\ \text{inch} = 3.625)$$

By varying "l" we change "n," for a given (fixed) "L" and "d." We try to juggle "l" so that "n" comes out as a whole number, which is convenient to wind.

We have to check that in fact this many turns of wire will fit physically into a length of 3-5/8 inch. I find that keeping the number of turns of coil down to six or less per inch seems to work well.

$$\frac{18.98}{3.625} = 5.24\ \text{turns per inch}$$

Having passed this test, we realize that our coil will look like Figure 3. Now the question becomes, how much wire did we "use up" in winding the coils? The wire used per coil, in feet, is:

$$\frac{19\ \text{turns}\ (3.14)^2}{12\ \text{inches/ft.}} = 9.94\ \text{feet}$$

For 2 coils, this amounts to 19.88 feet.

The balance of wire in the antenna is 69.79 - 19.88 = 49.91 feet. Dividing this remaining wire into two halves, one half for the "front" and the other half for the "rear" of the antenna, we get a picture of our loop as shown in Figure 4.

Mount the loop horizontally. The maximum radiation as shown above is from the far side of the loop back towards the feed point. Run the feedline away from the loop perpendicular to the plane of the loop for at least a quarter wavelength.

Comment on winding the coils: Spot the

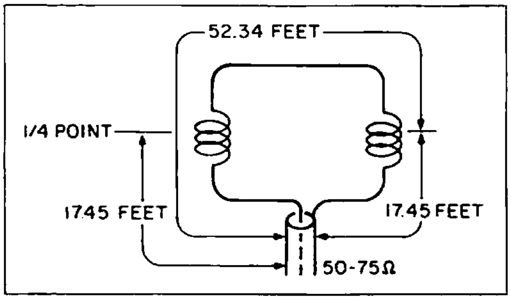


Figure 2. Dimensions of the 40m version.

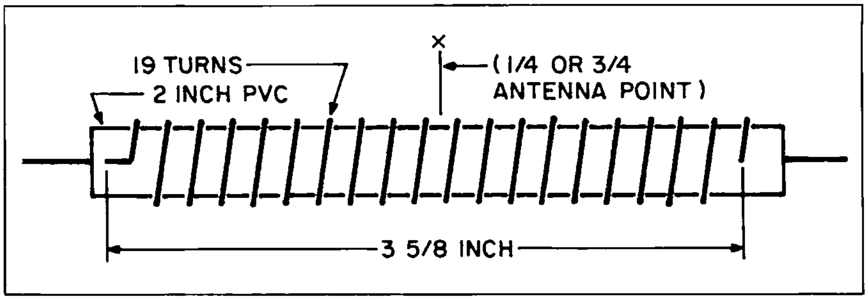


Figure 3. Coil winding details.

1/4 point (and again the 3/4 point) of the wire loop at the center of your coil form(s) and wind the coils in both directions onto the form to ensure that, when wound, the 1/4 point and 3/4 points on the antenna are, in fact, *exactly* at the center of the coils.

Comment on installation: The usual rules about installation apply. I've put my Baby Loops on the non-metallic roof of my QTH with barely a few inches clearance. My 12 meter Loopy faces ZL (from Hawaii) and I consistently receive reports one to two "S" units stronger in the desired direction, compared to my R5 (which, by the way, is a very effective antenna in its own right on 10 through 20 meters, including the WARC bands). The same loop gets me into the continental US, so evidently there is some side and high angle radiation.

Note that a half-wave loop for 40 meters will tune 10 and 20 meters as two- and one-full-wave loops respectively, with a preponderance of perpendicular (to the loop plane) radiation, and as multiples of a half-wave (in the plane) on 17, 15, and 12 meters. The former capability is useful for "short haul" (out to 2,500 miles) high angle radiation, while the latter shines on DX (low angle, long distance).

Regarding the Baby Loopy's size, as more wire is wound into the coils less is available for the remainder of the loop, resulting in a physically smaller and smaller loop. There will be some practicable limit to size reduction as a function of radiation efficiency, but I have yet to find that limit. (We're alluding here to a transition from use of the electric vector to the magnetic vector for radiation). My experience with the half-wave loops from 10 meters through 40 meters is that almost any size which is comfortable to build will work, as long as the inductive reactance of the coils is around 360 ohms. Varying the loop's physical size will of course alter the radiation pattern, which can best be modeled via computer program. Of direct concern to the amateur, however, is the resulting feed point impedance variation with change in loop size. However, the usual impedance matching methods apply (balun, series section transformer, etc.). A good ATU is the easy way out. Personally, I use nothing more than an L/C "Random Wire" tuner feeding coax to the loop.

So, if you have limited space, are unable to put up mega-arrays of antennas, and for whatever reason must erect low profile antennas, then the half-wave inductively loaded horizontal "Baby Loopy" may just be the answer. You'll realize gain, directionality, and some front-to-back and side rejection. They're easy to make, easy to install, and easy to tune. They work.

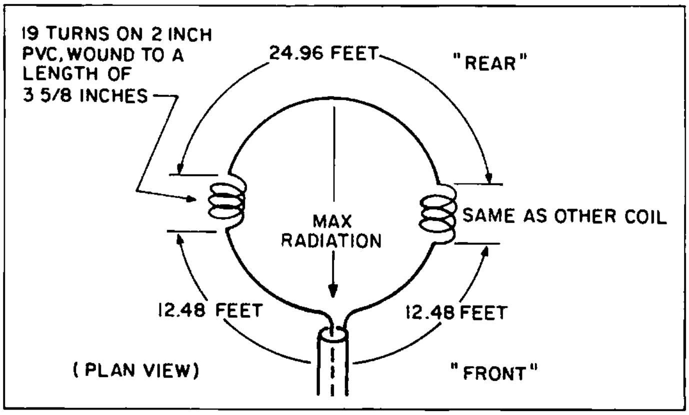


Figure 4. The baby loop can be thought of having a "front" and "rear" as shown.

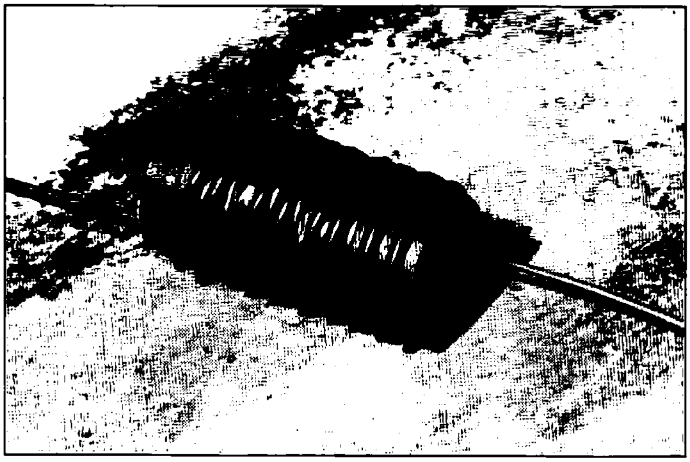


Photo B. A completed coil, wrapped in black vinyl electrical tape to hold the coils in place.

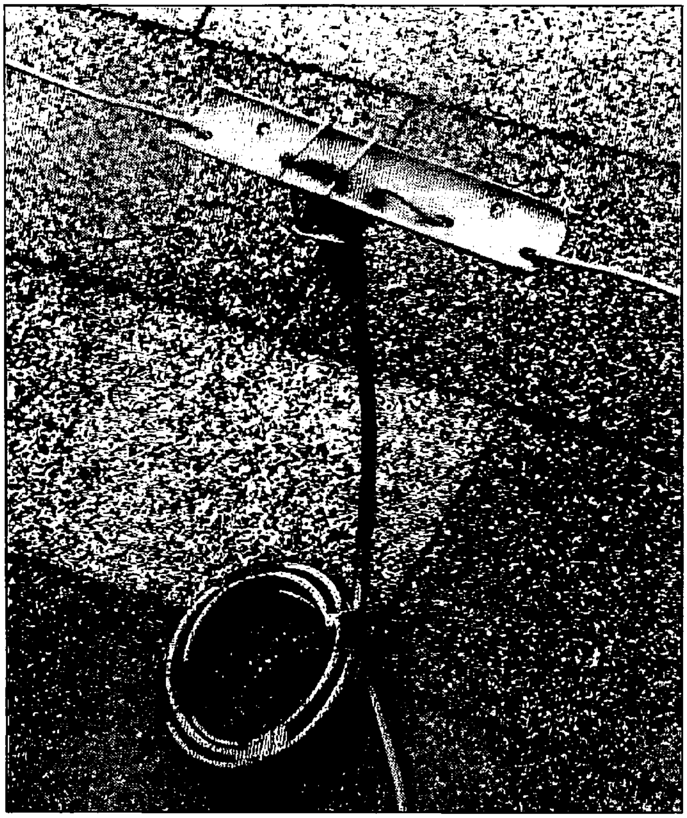


Photo C. The feed point of the baby loop antenna. A strip of PVC pipe (cut down the middle) was used to mount a SO-239 female connector and to support the antenna wire. Note also an RF air balun (1:1) formed out of coils of the feedline.

Number 11 on your Feedback card

Noise Reduction Using Broadband Active Whip Antennas

Clear reception for the VLF/LF bands.

by D. F. Curry WD4PLI/6

Active whip antennas can be used successfully in a number of applications where man-made noise such as light dimmers, power line hash, TV horizontal oscillators and other types must be reduced or eliminated in the LF/VLF spectrum.

The technique involves the use of two active whip antennas, both electrically identical but physically placed in a manner that allows phase cancellation of the noise, while allowing the signal to remain undisturbed. Similar systems have been developed (about the same time as my design), as noted in an exemplary article by Dave Robinson, "Active Wideband Interferometer Using Active Whips," featured in *Lowdown*, August 1990.

My particular requirement was the elimination of power line hash from a nearby high tension line. Noise blankers are effective for removing impulse noise with high amplitude spikes, but a poor choice when trying to remove "complex" noise such as power line hash that typically masks itself as the final word on your S-meter.

This circuit not only phase-canceled the power line hash but as an extra bonus substantially reduced the neighbors' TV horizontal oscillator harmonic, rendering another portion of the 1750 meter band usable. Figure 1 shows the basic block diagram of the two whip antennas and the phasing unit, along with the other equipment I used.

Keep in mind that this addition to any receiving station should be part of a "receiving system" that incorporates other beneficial receiving aids such as receiving processors and regenerative preamplifiers. The phasing unit will allow accurate adjustment of phase and amplitude of both signals independently. High quality active whip components can be purchased from manufacturers listed at the end of this article, or built from scratch using the circuit shown in Figure 2. The completed layout for the active antenna preamplifier and the phase shifter is shown in Figures 4 and 5. The PC boards shown in Figures 4 and 5 are available from Curry Communications (see the Parts List for details). The active antenna circuit boards are housed in small Hammond die-cast aluminum boxes for weatherproofing.

For the signal antenna, an SO-239 connector is used for the physical support and electrical connections to the wood mast and the steel CB whip. The "L" bracket is a common CB accessory, found at Radio Shack or other electronic stores.

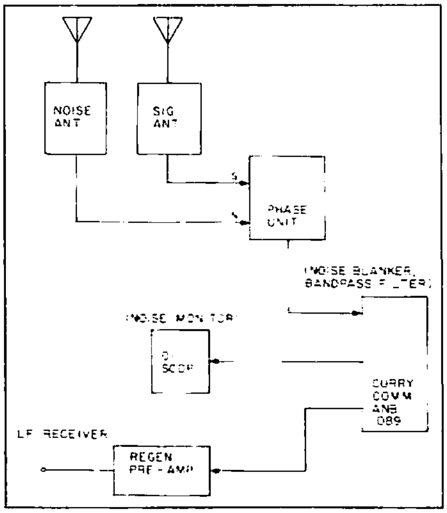


Figure 1. Block diagram.

The noise antenna can use either wire (for low profile) or aluminum rod antennas (as shown) for more rugged installations. Both work very well. If you use the rod version I recommend using two or three rods, approximately three feet long each. Flatten and drill the ends so they can be physically joined to a feed-through connection.

Connect equal lengths of coax to each preamplifier, using BNC connectors. After final installation and an operational check, spray the boxes and connections with a quality marine varnish.

The actual location for active antennas such as these is critical; sometimes the difference of only a few feet from nearby objects can make or break reception. The strategy behind experimenting with antenna placement is to find the lowest noise area possible *before* you begin the phase-canceling scenario.

The lowest noise spot at my location ended up being in the front yard, away from the house and power lines. Also, a separate ground system should be used for active antennas to eliminate ground loops and extraneous coupling of noise from power line related ground systems in the shack. The copper pipe used as the ground rod also supports the wood mast. The braid of each coax cable is connected to the ground rod. The noise is typically installed only a foot or two above the ground.

Phase Shifter

Figure 3 shows the phase-shift schematic, with input T1 and T2 used as isolation transformers to accomplish the necessary separation for the "house" and antenna ground systems. Switch SW1 A-D is an on/off switch and battery charge switch all in one. Please note that the switch, the batteries, and R17/R18 are not mounted on the circuit board, but wired separately. Also note the polarity of B1 and B2 wired to points E and F on the circuit board ground.

Points A-D are jumpers from the circuit board to SW1. Switch SW2 can change the input phase 180 degrees if required. R1 and R2 are load resistors after the voltage step-up transformers T1 and T2, providing an honest to god 50 ohm match at inputs J1 and J2. U1a and U2a are simple broadband amplifiers, with an amplification of 3.1 for buffering and overcoming some losses in the circuit. R7 and R8 are the volume or amplitude adjustment controls, which set the level to the phase-shifting stages, U1b and U2b. The phase-shift circuit is your classic "all pass" variety—it varies the phase from 0 to almost 180 degrees by controlling the potentiometers R11 and R12. R11 is used as a coarse adjustment while R12 is for fine tuning. Output from U1b and U2b is matched to the 50 ohm receiving port at J3 through R15 and R16 and phase shift transformer T3, an audio transformer that places the output signals from U1 and U2 180 degrees out of phase. This output from T3 is connected to your next stage, or your receiver.

Excellent nulls of 70 dB or better have been measured from 50 to 450 kHz using a signal generator as the common input source to J1 and J2, and an oscilloscope monitoring the output. Separate 9-volt batteries are used to power the phase shifter and active antennas. Using a 4PDT switch, rechargeable batteries can be recharged when the phase unit

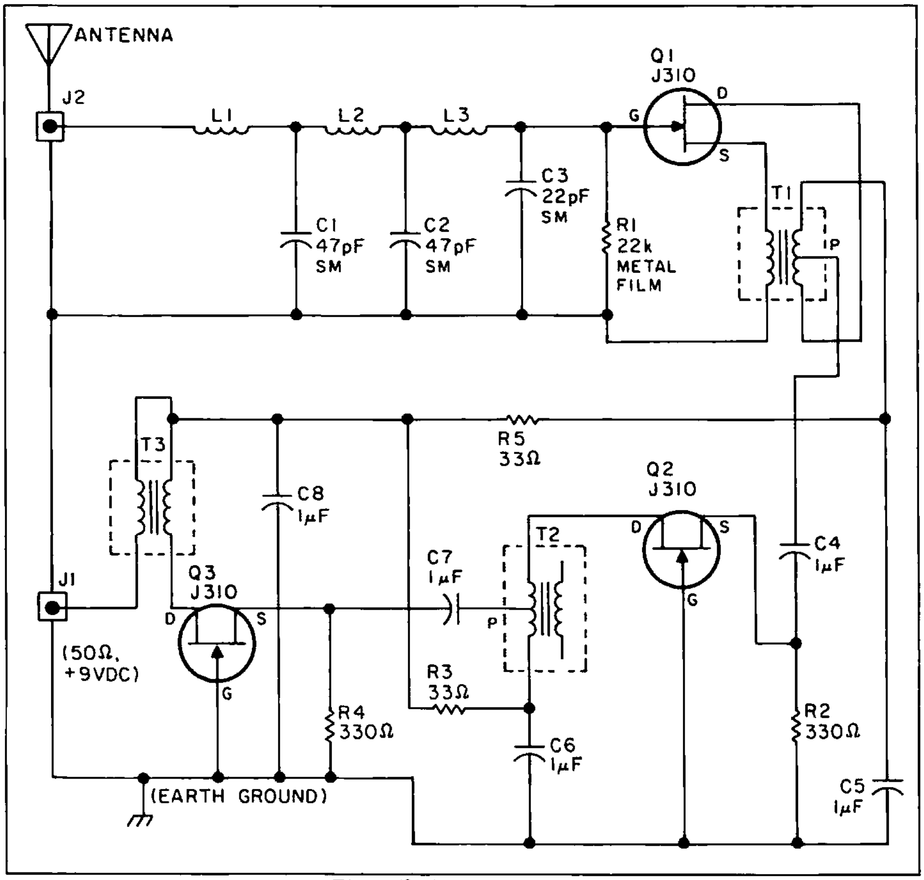


Figure 2. Antenna preamp.

PHASE UNIT PARTS LIST

B1-4	9 volt rechargeable batteries
C1, 4	680 pF Monolithic capacitor (or silver mica)
C2, 3, 5	1 μF monolithic 50 VDC capacitor
J1-3	BNC female chassis connectors
R1, 2	1.2k ohm 1/4 watt resistor Metal film recommended
R3, 4	470 ohm 1/4 watt resistor Metal film recommended
R5, 6	1k ohm 1/4 watt resistor
R7, 8	1k ohm 1/8 watt potentiometer. Mouser #31CX301
R9,10,13,14	2K ohm 1/4 watt resistors (metal film recommended)
R11	25K ohm 3/4 watt potentiometers, 20-turn Mouser #594-43P203. Also order cover, Mouser #594-612.
R12	5k ohm 3/4 watt potentiometer, 20-turn Mouser #594-43P502. Also order cover, Mouser #594-612.
R15, 16	600 ohm 1/4 watt resistor (metal film recommended)
R17, 18	Current limiting resistors, typically 620 ohms 1 watt for R17, and 150 ohms 1/4 watt for R18.
SW1	4PDT switch
SW2	DPDT switch, PC mount
T1-3	Mouser #42TL004. Note the "P" on the transformer, indicating the primary side.
U1, 2	TL072P low noise op amp

WHIP ANTENNA PREAMP PARTS LIST

C1, 2	47 pF silver mica
C3	22 pF silver mica
C4-8	1 μF monolithic chip/50 VDC
J1	BNC chassis femalo connector
J2	SO-239 chassis femalo connector
Q1-3	J310 low noise JFET
R1	22k ohm 1/4 watt resistor (metal film recommended)
R2, 4	330 ohm 1/4 watt resistor
R3, 5	33 ohm 1/4 watt resistor
T1-3	Mouser 42TL004 transformer, Note "P" for primary
L1-L3	J.W. Miller 70F823AI iron-core only
Box	Hammond 1590A (Available at Mouser #546-1590A)

Complete kits containing all components and PC boards are available from Curry Communications, 852 N. Lima St., Burbank CA 91505: The Phase Unit kit is $48 and the Antenna Preamp kit is also $48.00. Blank etched and drilled PC boards are available separately from Far Circuits, 18N640 Field Court, Dundee, IL 60118; the Antenna Preamp board is $3 and the Phase Unit board is $4. *Order L1-L3 directly from J.W. Miller at (213) 537-5200.

is off. Note the jumpers on the circuit board, points AA and BB. The phase unit circuit board can be made from the positive in Figure 5.

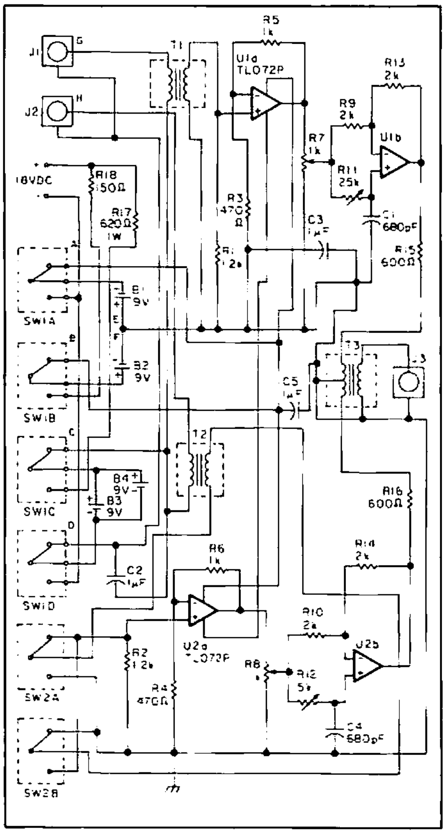


Figure 3. Phase-shift control.

Operation

Apply power to the phase shifter and antennas. The volume controls should be adjusted and reception confirmed. Adjust your receiver to a beacon or signal that you are familiar with, if possible. The volume setting of the SIGNAL channel should be about 3/4 to maximum, and the NOISE channel should be approximately the same. Rotate the FINE adjust phase-shift control to almost fully counterclockwise, and the COARSE phase-shift control adjusted while monitoring the noise floor. SW1 may also be switched for the correct phase input. The best results occur when the phase and amplitude of the noise of each channel is the same, and then canceled by T3. If you are unsure whether the channels are working correctly, a simple check can be done by connecting a single antenna or signal generator to BOTH inputs to confirm actual operation of the phase unit. With

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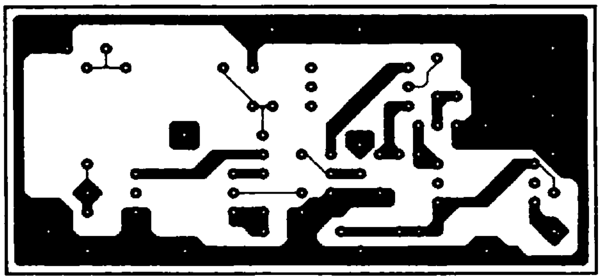


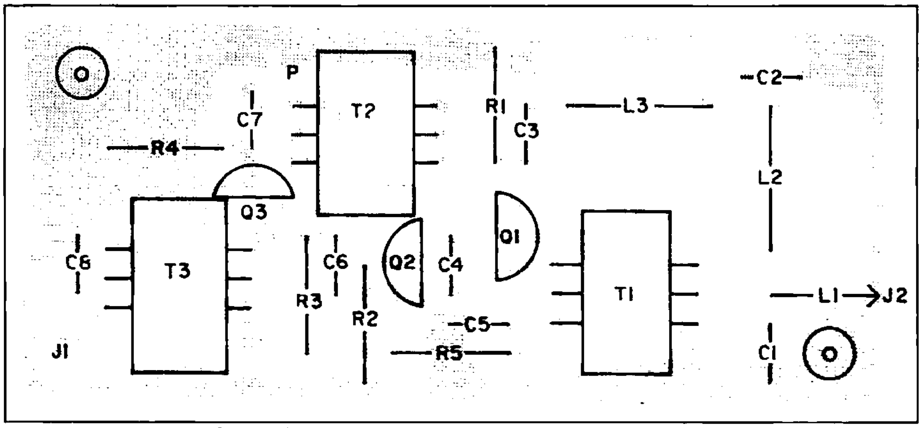


Figure 4.(a). PC board foil pattern for the antenna preamp. (b). Parts placement.

Packet Radio and Emergency Communications

Public safety enters the digital world.

by Richard Ferguson KAØDXM

Do you want to have a successful ham radio emergency group? This article describes how our group of hams in Boulder, Colorado, progressed from being an ordinary emergency group to a statewide example of what hams could achieve. Before, we were on the outside during emergencies; now we are an integral part of the countywide emergency plan. Packet radio can become your key to being accepted by public safety agencies. Our operational procedures and equipment are also explained, as they have been refined through three major forest fires.

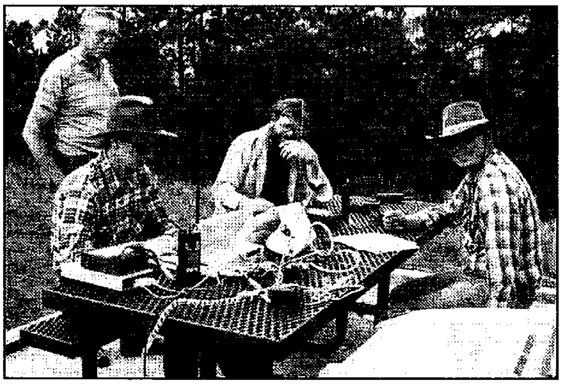


Photo A. One of the portable packet stations operating in the mountains near Boulder. (L to R): Al Beu WAØLMQ, Tim Groat KRØU, Ed Cole WBØSUT and George Becker. Photo by David Fetter KA3HBK.

A Little History

After a major flood in the mid-1970s, a local ham radio emergency group was formed. Boulder County Amateur Radio Emergency Services (BCARES) was active for a number of years but fell into dormancy by the mid-1980s. We were like many ham emergency groups: We had an army surplus communications van with lots of radios, but we were rarely called to serve. If volunteers are never used, they eventually lose interest.

Two things happened to change this. First, BCARES convinced the county communications center that packet radio might be useful. Second, Boulder County suffered a major forest fire. We obtained grants from IBM and the federal government for a demonstration packet radio system in a suitcase, using a Radio Shack Model 100 portable computer, a battery-powered printer, a TNC (terminal node controller or radio modem) and an ICOM IC-2 2 meter radio. The system was somewhat crude, but it worked.

Actually, two forest fires burned at the same time, stretching all local resources, including communications, to the limit. In one day, hams were able to set up three packet stations and one portable digipeater. One station was established at the county communications center, and two stations at the fire command centers, near the fire lines. The county was very impressed with the speedy delivery of hard copy, the relative security of the messages, and the hams' flexibility.

Of course there were problems with packet radio at these first fires, lots of problems: batteries went dead, systems stopped working, radio contact was noisy, etc. Luckily, ham ingenuity solved or worked around the difficulties and the system was used for several days, with only occasional periods "off the air." When the packet system was down or overloaded, messages were handled by voice on a 2 meter repeater.

After the 1988 fire, and every succeeding emergency, we had a critique and figured out what we needed to improve. We held exercises, some of which were disasters in themselves! As a result, we rewrote the ham radio emergency plan for Boulder County. In the 1989 forest fire, which destroyed 40 homes, things went more smoothly and BCARES became accepted as a key element in emergency planning. Packet radio is now written into the county flood and fire plans: BCARES is to be paged automatically when a situation reaches the critical point. At the start of the most recent forest fire, the county radio dispatchers were visibly relieved when BCARES arrived because we take a lot of the traffic load away from the public safety radio channels.

The Old Stage Road Forest Fire

Perhaps the best way to explain how BCARES operates is to tell the story of one emergency from beginning to end. This is the story of our third major forest fire, which burned a dozen houses in Boulder County in November 1990. It started early on a Saturday morning. The first that BCARES knew of it was when a sheriff's officer knocked on the door of one of our members and asked him to evacuate his home. This member called the head of BCARES, who began a callout in the middle of the night, anticipating the need. Soon after, we were paged by the county communications center, which requested packet links from the communications center to the fire base and the evacuation center. A voice net was set up on a local 2 meter repeater.

The Red Cross requested help at two additional locations. For the first time we had enough equipment to set up packet at all sites, so we decided to operate with one voice coordination frequency and all five packet stations connected to the same packet bulletin board. (In past emergencies, the hams serving the Red Cross had handled traffic by voice on a separate frequency).

During the two days of the fire a total of 225 messages were sent via packet radio. Forty-eight hams participated, putting in a total of 350 hours of volunteer time.

One new area that BCARES is beginning to exploit is ham fast-scan TV. In the Old Stage fire, a TV transmitter was set up on top of a hill, giving an overall view of the fire. For the first time, the dispatch center could actually see what was going on, rather than just imagine it through radio traffic. They loved it! On the second day, the fire base requested a receiver too; they were too close to the fire to get the big picture!

Organizing the Hams

A key to success is having several experienced people at the net control site. Our experience is that one ham alone cannot do a good job of coordinating an operation; it is much better to have one ham at the mike and one in the background, thinking. This also means a smooth transfer when the ham at the mike needs to take a break. When most of the traffic is handled by packet, the voice frequency is relatively quiet, and the net control usually does not have to work too hard after things are running.

In a major event with multiple sites, coordinating people is a big job, too big for one person to do well. We have certain people preassigned to key sites and to management of personnel. We use six-hour shifts, based on a survey of our members' preferences. This allows people to work a half day and help with the emergency, too. We generally assign three hams to each site. This provides one person for voice, one for packet, and one to deliver

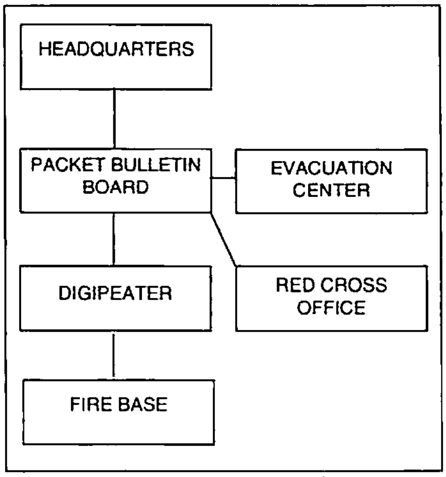


Figure 1. Typical packet radio network block diagram.

messages or provide relief. One of these three hams is the team leader for that site.

BCARES has a list of 50 official members, plus a list of other people upon whom we can count. We assign the most experienced members to key sites and key jobs, then fill out the staffing with others. We often accept volunteers who we do not know, but pair each with a ham who is experienced in our procedures.

Most of the hams are assigned by telephone, but we usually monitor a 2 meter frequency as well. At 9 p.m. each night, a net is run to finalize assignments for the following day. The staffing frequency is different than the operational frequency. People asking questions or sharing information are referred to the staffing frequency in order to keep the operational frequency clear.

Packet and Message Handling

Do not forget these traffic handling basics: Every message needs a number, an addressee, a destination and a signature. The sender's signature is perhaps the most important item. The sender's title and agency should be included with the name. We have developed a standard message format, and packet's error checking features make word count unnecessary for local communications.

The basic procedure at each site is simple. When a ham receives a written message, he checks it to make sure it is signed, addressed and legible. Then he SENDs the message to the appropriate site, typing it directly (via packet radio) into the bulletin board. When the message is finished, the other station receives a one-line notice of mail, then READs the message. After receiving the message, the station acknowledges by voice, i.e. "Fire base, this is dispatch, acknowledging your message 123." The acknowledgement is accepted with a "Thank you," and the message is torn off the printer and delivered. We use tactical calls, such as "fire base," rather than ham calls, on both voice and packet. This minimizes confusion when the ham at the fire base mike takes a break or goes home.

Why Is Packet Successful?

The most important fact is that all of the agencies that we serve like the hard copy messages. The police and fire departments have voice communications, but hard copy from point to point is something else. Packet's automatic error checking also provides protection against garbled messages. In most instances, receiving a computer-printed message is much better than trying to interpret cryptic notations scrawled on cards. Most of the traffic that BCARES handles relates to logistics. (i.e. "Please send 50 shovels." or "We need 35 meals at the fire base at 5 p.m.") In addition to providing hard copy, we provide additional communications operators, as well as additional frequencies.

Packet Hardware and Software

Our present packet system consists of four parts: portable packet systems, fixed packet systems, mountaintop digipeaters and a packet bulletin board.

The portable packet systems consist of a Toshiba T-1000 laptop MS-DOS computer, two ICOM IC-228 2 meter transceivers (one for packet and one for voice), a TNC, a battery-powered thermal printer, a 20 amp-hour lead-acid gel-type battery, a battery charger, and antennas. To keep this from being a backbreaking load, it is divided into two suitcases, plus beam antennas.

The fixed packet systems are standard MS-DOS computers, but with a TNC and a 2 meter radio. These computers are available for general use in the dispatch center or other area, but can be switched rapidly to be used as packet stations when needed.

The software that we use on the fixed and portable computers is Pak-Comm, by Kalt and Associates. However, we generally use the computers as "dumb terminals" with printers because most of the "smarts" are in the bulletin board.

We also use mountaintop digipeaters to provide coverage to remote areas of the county. We are now upgrading these digipeaters with ICOM IC-228 radios.

The bulletin board uses a 150 watt radio at a hilltop site, and an MS-DOS XT-type computer. The TNC is an internal unit made by Digital Radio Systems of Clearwater, Florida. The PacketCluster bulletin board software is available from Pavillion Software of Hudson, Massachusetts. The key feature of this software is that it allows many different stations to be interconnected through the bulletin board at the same time. This means that one does not need to connect to and disconnect from each station to send a message. The message flow does not stop if a station is already connected to someone else. The message is typed into the bulletin board at the operator's speed, and when the message is ready the other station receives a one-line notice of the message. The basic commands, SEND and READ, are simple enough to be readily learned even by those not "computer literate." Direct connection from one station to another is usually simpler if only two stations are involved, but with multiple stations the bulletin board makes life a lot easier. The bulletin board is available for general use until an emergency is declared.

BCARES does not use the PacketCluster software features that allow transmitting DX spotting bulletins or connecting to other bulletin boards. Another bulletin board is available to send messages to other parts of the state or across the country but we have never had occasion to use it in a real emergency.

In December 1991, we tested a system of linked PacketClusters; this system is normally used for DX spotting in the Denver metro area. The system consists of three PacketClusters, each with their own 2m frequency, connected on 440 MHz. This test was very successful; even the skeptics were impressed. We had 50 stations connected at the same time, with 15 stations throughout the area involved in the exercise. Messages flowed transparently and rapidly from cluster to cluster; the system truly operated like one big bulletin board! We plan to use this system for major disasters involving packet traffic between counties.

Packet Problems and Pitfalls

Packet can be wonderful, but it can also be a big problem. We have spent innumerable hours discussing and experimenting with TNC parameters. After several years, we have settled on the parameters listed in Table 1. These assume a PacketCluster bulletin board, but seem to work well for general purposes. Perhaps the most important parameter is FRACK, which defines the time between retry transmissions. People get impatient and tend to set FRACK very low. However, if multiple stations on the same frequency do this, everybody ends up transmitting at the same time and nobody gets any traffic through. If you want a real disaster, have four or five stations typing on the same frequency, with FRACK set to about 2. The weaker stations will soon retry out and be disconnected.

Channel overload can be a real issue, even with correct parameter settings. In an overload situation, weak stations will be disconnected and it will take forever for a message to get through. There are two ways to deal with this problem. First, you can use more than one frequency. We recently upgraded our bulletin board to use two frequencies, and we estimate that we have almost doubled our traffic handling capability. A lower-tech solution is having the net control tell two packet stations to QSY to another packet frequency. To minimize interference, we do not operate on the national packet frequency of 145.01 MHz.

The second option is to limit or shut down lower-priority traffic. If you are handling disaster relief traffic, do not allow health-and-welfare inquiries to bog down the system. If you have an emergency message, order the other stations to stop typing.

A key to maintaining control is to require all packet stations to simultaneously monitor a voice frequency. This makes coordination and debugging problems much easier. We use a voice 2 meter repeater and a packet 2 meter frequency, with digipeaters if necessary. There is some interference, but it is usually not a big problem. A packet monitoring station, most often manned by a packet radio expert from his home, can also be useful in spotting prob-

lems and suggesting solutions.

Relationship of BCARES to Other Groups

The relationship of BCARES to the public safety organizations is virtually unique. Unlike a conventional ARES group, chartered by the ARRL, BCARES is chartered by the county communications center, which dispatches police, sheriff, fire, and other agencies. We are also sponsored by the Office of Emergency Preparedness (Civil Defense). By being government chartered, we are more accountable to the organizations that we serve. Boulder County's three ham radio clubs jointly support BCARES. The head of BCARES is recognized by the ARRL as the Emergency Coordinator for Boulder County, and BCARES is also legally the local RACES organization, but these titles are not important in our local emergency operations.

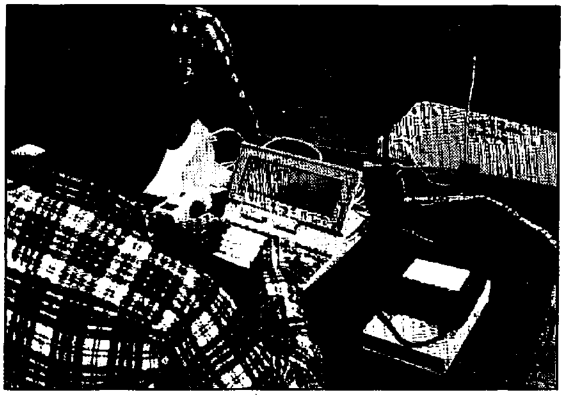


Photo B. Tim Groat KRØU transmits a packet message from the simulated fire line to the Boulder Public Safety building. Each packet field station consists of a laptop computer, printer, VHF radio, TNC and a gel-cell battery pack. Photo by David Fetter KA3HBK.

BCARES's first responsibility and primary focus is assisting the countywide communications center; any other requests for assistance are met only if resources are available. We primarily provide local communications via VHF packet and voice, although the public safety organizations know that we have other capabilities, such as HF, autopatch, etc. BCARES has never used traditional "long-haul" HF communications capability.

Traditionally, ham groups have been associated with the Red Cross or the local civil defense organization. Incoming health and welfare inquiries are a major part of what hams do in emergencies. These are worthwhile endeavors, but can limit the ham role. In some ways, the primary accomplishment of BCARES is that it has expanded the role of hams in emergency communications. To keep within our focus, BCARES does not plan to handle health and welfare traffic; we have determined that this is primarily the Red Cross's responsibility.

In Boulder County, the Red Cross has a separate group of hams that assist them with communications. BCARES and the Red Cross hams enjoy a cooperative working relationship. We share resources and hold joint exercises. We have discussed the possible merger of the two groups, but the agencies that we serve feel that they prefer two more focused organizations rather than one group that tries to be all things to all people.

How To Make Your Group Successful

BCARES has been successful by maintaining a focus on serving our "customer," the countywide communications center. A close relationship between the head of BCARES and an official of the countywide communications center has also been beneficial. The chairman of BCARES works closely with this official on both personal and professional levels. In effect, the people of the communications center depend on the head of BCARES to assure that the hams meet the communication center's needs.

How can you make your emergency service group successful? Sell yourself to someone who needs you. The first step is to sell your group to an agency in order to get them to "try the hams out" by including you in either one of their disaster exercises or in a real emergency. Choose an agency with which the hams have connections, or an agency that often has a need for supplementary communications.

The second step is to be successful in your trial. The key here is not to promise more than you can deliver. Be realistic. Plan ahead, practice, and then get the job done. Plan for equipment problems, and have backup equipment to ensure success. Focus on helping the agency, rather than getting written up in the local newspaper or getting your name in a ham magazine. Participate in the annual disaster exercises for the organization that you serve.

People are impressed by technology, and you will probably be more successful selling something that they don't already have. Most public safety organizations already have lots of HTs and people with clipboards. Do a demonstration of packet radio and hand them the hard copy. Perhaps a live TV picture would be useful—do a small demonstration, and persuade them to give you a try.

If you focus on serving one agency, and do what they need you to do, your group can be successful. Perhaps your group, like BCARES, will hear, "In a disaster, the dispatch center calls the hams before they order food."

TABLE 1. RECOMMENDED TNC PARAMETER SETTINGS

MAXFRAME 1
DWAIT 16 (low power stations use DWAIT 8)
FRACK 8
RETRY 10
CHECK 0
AX25L2V2 ON
SLOTTIME 10 (if supported)
PPERSIST ON (if supported)
PERSIST 63 (if supported)
(low power stations use PERSIST 128)

The above parameters are for a TAPR 2 or a modern TNC. For an older TAPR 1 TNC, use DWAIT 4, or DWAIT 2 for low power stations.

HOMING IN

Number 13 on your Feedback card

Radio Direction Finding

Joe Moell, P.E., KØOV
P.O. Box 2508
Fullerton CA 92633

Photo A. KK6CU shows how his mobile CRT display is used. The storage scope is in a very deep cabinet, so it goes on the floor in front of the passenger/navigator.

Toward the Optimum Mobile RDF System

In four years of writing "Homing In," I have discussed many different kinds of equipment for hidden transmitter hunts (sometimes called foxhunts or T-hunts). It should be clear by now that there is no single setup guaranteed to be ideal for every radio direction finding (RDF) situation.

Two meters is the most popular band for mobile foxhunting, and it's the VHF band that needs the most RDF work for self-policing. The beginning 2 meter hunter must choose among yagis, quads, Dopplers, phased arrays, and time-difference-of-arrival (TDOA) units. Each has advantages and disadvantages.

Most hunters hereabouts start out with a yagi or quad, rotated by hand on a mast extending out the vehicle window. They use their radio's S-meter to find the direction of the strongest signal, with an RF attenuator to keep the meter on scale when closing in. As they become more active, RDFers often drill a hole through the roof center or devise some sort of special rooftop antenna rotating system. Then they can turn a long beam without excessive (and illegal) overhang beyond the sides of the car.

Beam users say their method outperforms Dopplers and TDOA sets because the beam's high gain pulls in the signals of weak hidden stations. Furthermore, the beam can be oriented to hunt foxes that are either horizontally or vertically polarized.

In urban areas where multipath is present, the various direct and reflected signal components can be isolated as the antenna is rotated. That's a major advantage of the beam method over a Doppler or TDOA. But it's also a disadvantage, because interpreting the indications can be tricky and time-consuming.

Sometimes the S-meter reading constantly fluctuates as you roll along, due to signal flutter, multipath, and path blockage. That makes it a real chore to get an accurate bearing on the direct signal, while ruling out the reflected signal indications. Wouldn't it be great to be able to automate the process? After all, this is the '90s!

A Scope, Not a Meter

An installation that continuously rotates the beam and displays a polar plot of signal strength versus azimuth would be a real boon. Like a radar scope, the display should have some persistence so that the operator can easily "stack up" traces to tell the difference between momentary flutter and the more stable and repeatable direct signals.

The idea of radar-like display for VHF RDF isn't new. The late Jim Davis W6DTR built just such a system almost 30 years ago. His readout used a surplus cathode ray tube (CRT) with a long persistence P7 phosphor. Jim never got around to motorizing the antenna. He just turned it by hand to sweep the display around. Still, he became unbeatable in the Fullerton Radio Club transmitter hunts because his system was far more advanced than any other hunter's.

I received lots of inquiries after WB6UZZ and I wrote about the DTR scheme.* Many readers were convinced that this would be the perfect "secret weapon." Some have tried to emulate it and update it. One of the most successful so far is JaMi Smith KK6CU of Pasadena, California.

JaMi loves to prowl the swap meets, looking for bargain radios, computers, and test equipment. He was able to locate inexpensive Tektronix Model 603 medical storage oscilloscope monitors for his RDF displays. (See Photo A. He has two of these setups, one at home and one in the car.) This saved him the task of building P7 CRT readouts, with their associated high voltage power supplies.

What's more, the storage scope is more "user-friendly" than a regular CRT because the operator can choose when to record traces and when to erase them with the press of a button. JaMi lets the traces build up for as long as he wants, then holds them in place while he measures them with the protractor he mounted to the face of the screen.

The storage scope requires 120-volt 60 hertz power. KK6CU uses an inexpensive square-wave DC-to-AC inverter made by Tripp Lite in his mobile installation. The inverter also provides AC power to the antenna rotating motor.

Automatic Polar Plots

When manufacturers want to know exactly how well their beam antennas perform, they take them to an antenna test range. Conditions there are ideal. Antennas are mounted on a tower high and clear of nearby objects. The test emitter is also in the clear, and the path to it is unobstructed. The results are those nice polar plots you see in the ads.

Under ideal path conditions with a single incoming signal, a CRT-type RDF gives a very similar display, as shown in Photo B. The large lobe indicates the direction of incoming signal. In this instance, it's 290 degrees relative to the vehicle. The higher the beam's gain, the sharper and narrower this lobe will be. The smaller lobes at 35 and 195 degrees could be signal reflections from nearby terrain features, but more likely they are minor lobes in the antenna pattern.

In a perfect situation like this, you

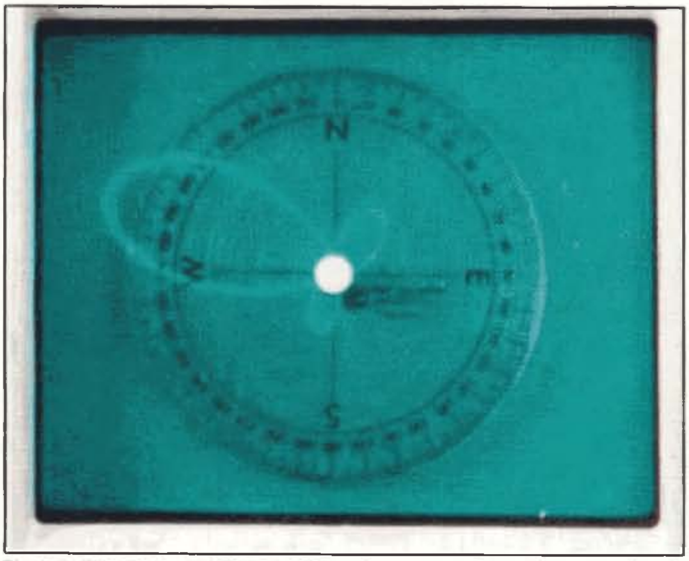


Photo B. The display of KK6CU's RDF system on a single continuous-carrier signal in the clear. It looks just like a polar plot of the 6-element quad.

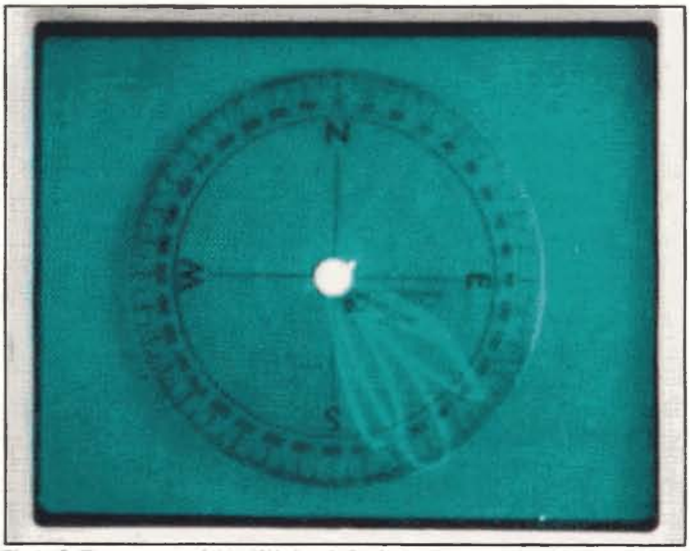


Photo C. Two sweeps of this CW signal give indications at 115, 130, 150, and 160 degrees. When you're in motion, it's hard to tell which is correct by reading the bouncing S-meter.

could get a bearing just as easily by hand-rotating the beam and watching the receiver S-meter. But the high-tech display excels when the RDF environment gets unfriendly. It's much harder to interpret the S-meter reading when there is mobile flutter on the hider's signal. Worse yet, imagine the S-meter bounce when the signal switches on and off every second or so. (It's legal on some hunts!)

We gave JaMi's setup a workout by tracking a seismic beacon that sends keyed CW. Photo C shows two sweeps of the antenna. Because the signal is going on and off at the CW rate, each sweep gives two different apparent bearings. This illustrates the likelihood of error in an ordinary "spin it and read the S-meter" setup when the signal is keyed or fluctuating.

Since JaMi's beam rotates at 40 rpm, it takes only 30 seconds to build up a trace of 20 overlapping rotations on his storage scope (Photo D). Now it's easy to see that the correct bearing to the beacon is 145 degrees.

When the Going Gets Tough . . .

The CRT display is at its best in a "messy" RF environment. In Photo F, the large repeatable lobe easily identifies the direct bearing to the T, while reflections and noise in other directions show up as a jumble of non-correlated traces.

Suppose there are two hidden transmitters on the air. Then you'll get an image like Photo E, which was taken at the start point of a Saturday evening T-hunt. The hidden T for the evening is at 85 degrees. The lobe at 275 degrees is the fox for a daytime hunt that was still in progress on the same frequency. The single trace that goes off screen was caused by a momentary transmission from one of the hunters on the hilltop.

Note the fluctuation in the westerly signal. The hider isn't varying power. (That would be a no-no on this hunt.) The T may be near large moving objects. Perhaps it's right next to a freeway. Or there might be nearby aircraft causing reflections and flutter. Despite the fluctuations, it is easy to get correct bearings by "eyeball averaging" the storage scope display.

Doppler Beater?

Users of Doppler RDF units (see "Homing In" for February 1992) will say that their method is faster (hundreds of bearings each second) and it latches on to short transmissions with ease. PIN-diode-switched Doppler arrays have no moving parts and are much less conspicuous. Dopplers are easier to use because they have fewer controls to adjust.

Those claims are true, but the beam/CRT configuration tops Dopplers in other important respects. Its high gain antenna makes it much more sensitive, so you can hunt stations at much greater distances. With a twist of the quad's boom, KK6CU can track horizontally polarized foxes with the correct polarization, while Doppler users are stuck with vertical antennas.

The biggest advantage of the scope over a Doppler is its ability to analyze multipath and multi-signal situations. On the other hand, a Doppler set must give a single indication. It can't separate the two simultaneous equal-amplitude foxes of Photo E. Its indicator will probably not point to either one.

The polar plot gives a moving picture of the channel that clearly displays both hidden T's, and the operator can identify each one by ear from the receiver audio as the beam goes around. You'll appreciate this feature when you are jammer hunting because it becomes easy to separate the jammer's signal from that of the station being jammed.

One more advantage: Multiple sweeps of the CRT system will get bearings on single-sideband signals and pulsed noise sources. Dopplers, on the other hand, require carrier-type signals. They can't track SSB or noise.

Next month's column will show you how KK6CU designed and built his motorized mobile antenna. It really stands out! You'll also learn how the antenna's azimuth is sensed and how JaMi solved the problem of getting the RF signal from the 40 rpm whirling quad to the 2 meter receiver. 73

* See pages 249 to 255 of *Transmitter Hunting—Radio Direction Finding Simplified* by KØOV and WB6UZZ, published by Tab Books (#2701), available from Uncle Wayne's Bookstore.

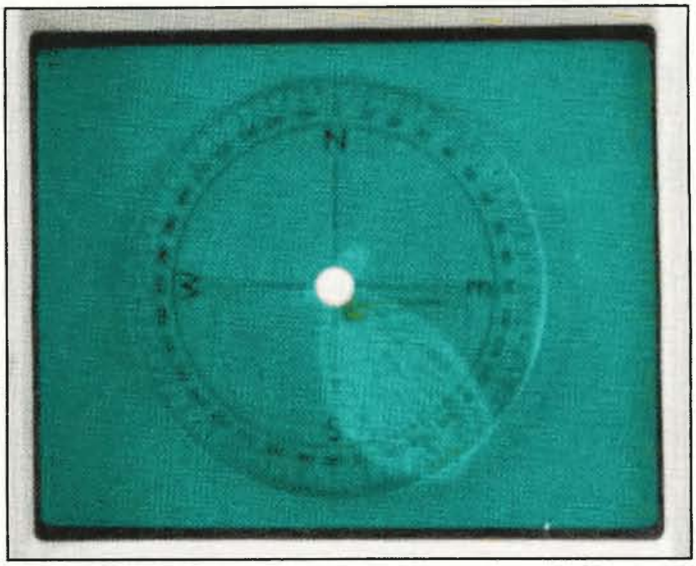


Photo D. Once 20 sweeps have built up on the storage scope, it's clear that the correct bearing is 145 degrees.

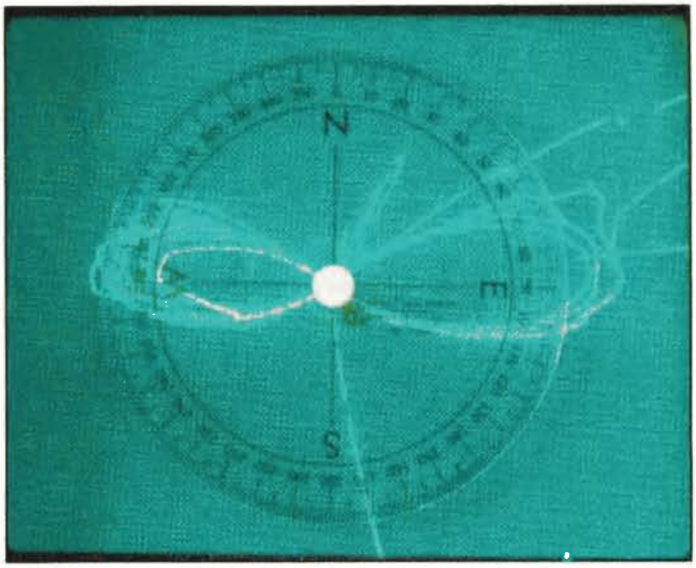


Photo E. A Doppler can't separate two simultaneous signals of equal amplitude, but KK6CU's CRT display and a good beam make it look easy.


Photo F. The hidden T bearing stands out in sharp contrast to noise and multipath. Note that JaMi adjusted the compass rose to compensate for his vehicle's 25 degree heading on the hilltop. This makes the 105 degree lobe a true bearing (referenced to north) instead of relative to the vehicle.

Number 14 on your Feedback card

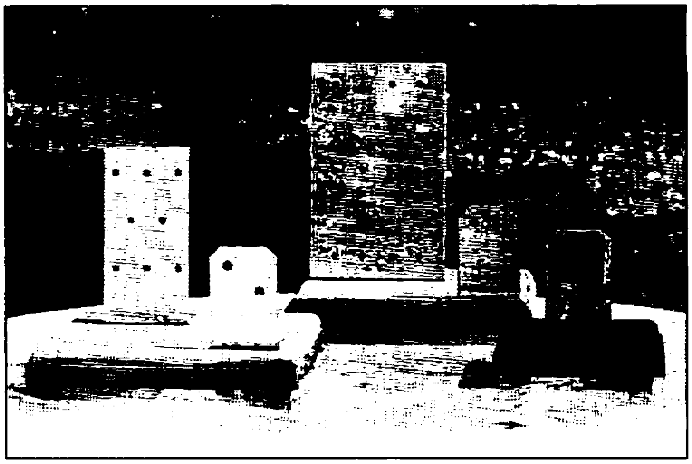
NEW PRODUCTS

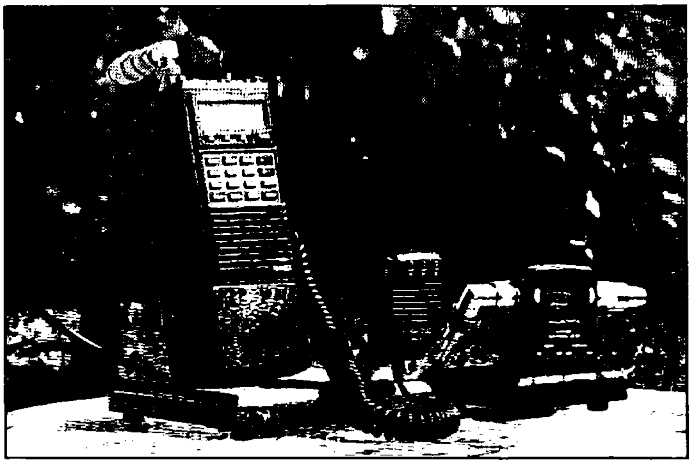
Compiled by Hope Currier

HANDIE-BASE

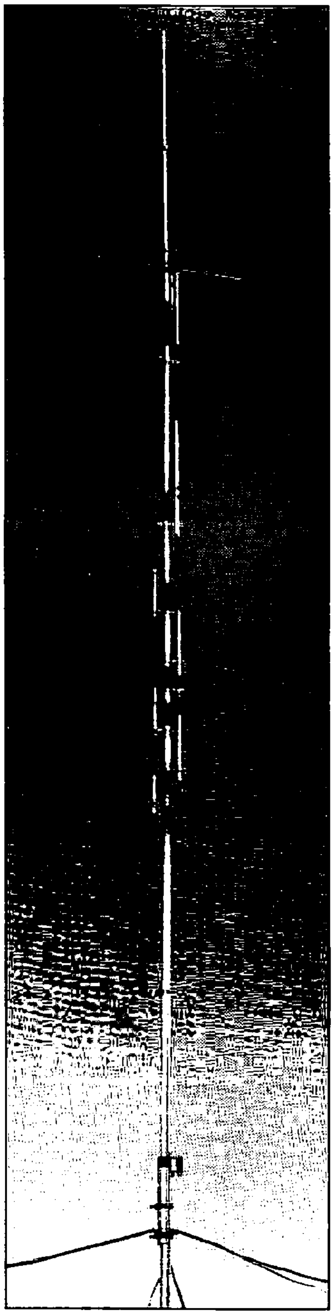
The Handie-Base is a stand lor your handie talkie or hand-held scanner, offering a steady, secure place for operating at your desk, coffee table, dining table or any other flat surface. The Handie-Base is constructed of wood and metal, with rubber feet to prevent sliding. If your hand-held radio has a belt clip, this device will provide a site for using it as a portable, or you can attach coax from an external antenna, along with a power supply and an extension speaker mike, thus creating a base station from your hand-held radio. No more dragging cords around to get the maximum output from your talkie or scanner. It also allows for using your handie talkie as your packet transceiver without hunting to find a place for your radio. These stands will last for years and carry a five-year repair or replacement warranty.

The stands are $14.95 plus $3.50 shipping and handling (check or money order). Other models are available for hand-held scanners, tall battery handhelds, and small SWR/power meters. Contact *Handie-Base & More, P.O. Box 2504, Broken Arrow OK 74013-2504; (918) 357-2139.*. Or circle Reader Service No. 201.





CUSHCRAFT



Cushcraft Corporation has Introduced the next generation of its eight-band quarter-wave antenna. The 26-foot AP8A covers 10, 12, 15, 17, 20, 30, 40 and 80 meters and weighs only 9.5 pounds. Constructed with double- and triple-wall tubing, the AP8A provides uncompromising strength for high wind survivability. Low-loss design and high-efficiency traps add up to maximum output. Today's active amateur will get superior eight-band operation with automatic bandswitching in one compact package. With quick assembly and a clean profile, the rugged AP8A will provide years of pleasure for amateurs and SWLs alike.

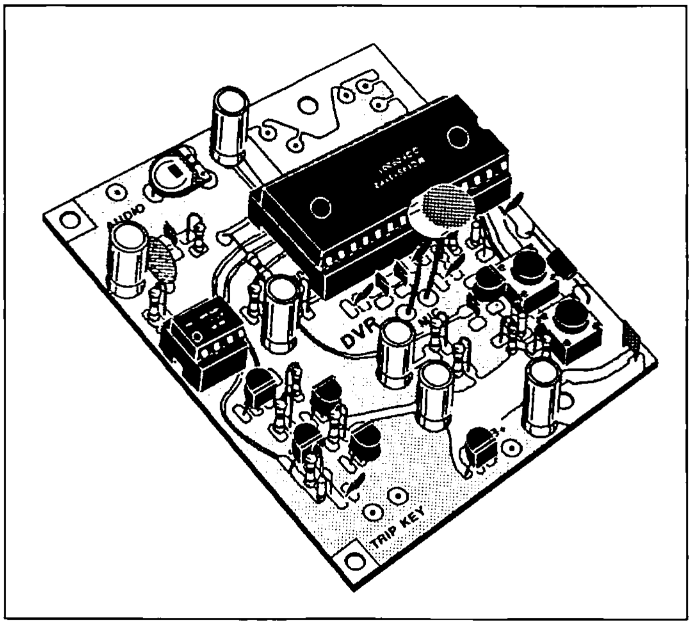
For the price and more information, contact *Cushcraft Corporation, P.O. Box 4680, 48 Perimeter Rd., Manchester NH 03108; (603) 627-7877, Fax: (603) 627-1764.* Or circle Reader Service No. 202.

CABLE X-PERTS

Cable X-Perts, Inc. has introduced an old favorite with a new twist: clear-jacketed RG Mini 8 (X). This new product has a very soft, extra-flexible, ultraviolet-resistant clear PVC jacket. Clear Mini 8X can blend into any surroundings, is aesthetically more appealing, and still has the same electrical characteristics as the standard 95% braid coverage black-jacketed material. The price is $.19 per foot for 100 feet and up. For more information, contact *Cable X-Perts, Inc., 113 McHenry Rd., Suite 240, Buffalo Grove IL 60089; (708) 506-1886.* Or circle Reader Service No. 203.

HAMTRONICS

The DVR-1 Digital Voice Recorder is a versatile PC board module designed primarily as a voice ID'er for repeaters, but also providing features that let you use it as a contest CQ caller or a "radio notepad" to record short parts of received transmissions for instant recall. As a repeater IDer, the DVR-1 module will record your voice, using either the built-in microphone or an external mike. It can be used with almost any repeater COR module. The 20 seconds of recording time can be broken up any way you like. You can enhance the basic circuitry by adding a switch to select any of several messages, or set it up to announce periodically, even when the repeater is not in use. Using it as a contest annunciator, you can record a message or even several messages. Eliminate fatigue or strained voice working contests or DXI As a radio notepad, you can keep the DVR-1 module wired to the audio output of a receiver, ready to record up to 20 seconds of anything you might want to recall later.

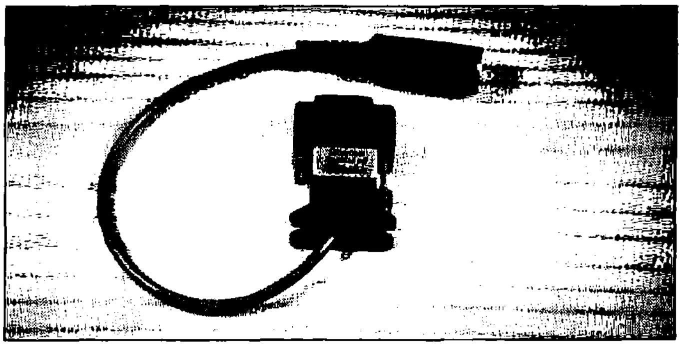


The DVR-1 module can be purchased either in kit form for $89 or as a wired and tested unit for $139. It includes a small electret microphone and push-buttons for record and playback. For more information and/or a complete catalog, contact *Hamtronics, Inc., 65-E Moul Rd., Hilton NY 14468-9535; (716) 392-9430, Fax: (716) 392-9420.* Or circle Reader Service No. 204.

MICROCRAFT CORPORATION

Microcraft Corporation has introduced the Personal Code Explorer, a new shortwave radio code processor for IBM compatible computers. Powerlul software and hardwire combine in an exciting new product that reads Morse, RTTY, ASCII, SITOR/AMTOR, HF packet, and multi-level grayscale Fax signals to your computer screen. Personal Code Explorer untaps all of the power of your computer to provide more features per dollar than ever before. Exclusive highlights include a real-time on-screen oscilloscope to observe signals, digital noise filters, Microcraft Morse code algorithms, a user friendly interface, and more! Personal Code Explorer's hardware installs easily on your serial COM port and does not need a separate power supply. No need to open your computer case, either. Hookup to your radio speaker or headphone jack is easy. Personal Code Explorer supports CGA/EGA/VGA video and requires DOS 3.0 or above. It runs from a floppy or hard disk. A clear, comprehensive manual is included. Exploring code has never been so easy—or so much fun!

Personal Code Explorer is $129 plus $4 shipping and handling. For more information, contact *Microcraft Corporation, P.O. Box 513, Thiensville WI 53092; (414) 241-8144.* Or circle Reader Service No. 205.

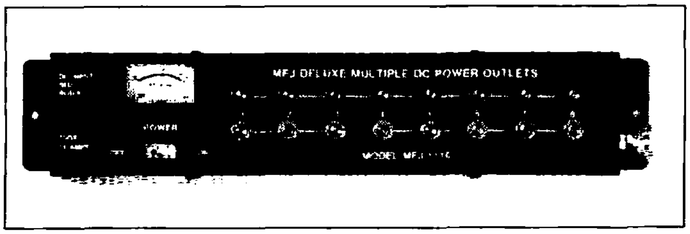


PacComm

PacComm Packet Radio Systems has introduced two new products: BayMod-9 and PacTOR. The subminiature BayMod serial port modems use BayCom TNC emulation software to access your radio through a serial port of the PC. The modem comes in two styles: BayMod-9 for 9-pin serial ports and BayMod-25 for 25-pin serial ports. PacComm's VHF serial port modems are the simplest and easiest way to get started on packet. The entire modem is contained in the serial cable housing. Simply plug the modem into the computer's serial port, attach the cable to your radio, and load the BayCom software. A BayCom software diskette and manual are included with each modem.

PACTOR is an entirely new ARQ radioteletype mode designed to overcome the shortcomings of both Packet and AMTOR for HF operation, providing a more rugged correction scheme and better throughput than AMTOR, making it a much more robust protocol than Packet under poor propagation conditions. PacTOR from PacComm is a hardware/software system which gives a four-fold throughput increase over AMTOR, while allowing the data flexibility packet users have become accustomed to. The PacTOR unit also supports AMTOR and RTTY operation, making it ideal for all modes of HF operation.

BayMod modems are $65 and the PacTOR unit is $290, plus tax (in FL) and shipping for each. For more information, contact *PacComm Packet Radio Systems, Inc., 4413 N. Hesperides St., Tampa FL 33614-7618; (813) 874-2980, (800) 486-7388, Fax: (813) 872-8696.* Or circle Reader Service No. 207.



MFJ

MFJ Enterprises, Inc. has announced the new MFJ-1116 Deluxe DC Power Outlet with voltmeter, switch and fuse. The MFJ-1116 is a neat and easy way to distribute 12 VDC to various transceivers and accessories. This multiple DC power outlet strip features eight terminals for connecting rigs and keyers, TNCs, tuners, etc. Output voltage is continuously monitored on its built-in voltmeter. The MFJ-1116 has a heavy-duty master power switch and a 15 amp fuse. Each of its eight outlets utilize heavy-duty five-way binding posts with standard spacing for dual banana jacks. Outlets are also RF bypassed. It can be installed on the rear of your desk and be used to eliminate "haywires."

The MFJ-1116 is priced at $44.95. For more information, contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323-5869, (800) 647-1800, Fax: (601) 323-6551.* Or circle Reader Service No. 206.

Number 15 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

OSCAR-21

AMSAT-OSCAR-21 was launched by the USSR on January 29,1991. It is also known as RS-14, RADIO-M1 and RUDAK-2. Groups in Molodechno, Moscow, Minsk and Munich were involved with its design and construction. The results of their efforts went to space as a part of the Soviet geological research satellite called *GEOS*.

Descriptions of the amateur radio components and complete frequency charts appeared in the May 1991 "Hamsats" column. The Soviet equipment included Mode B (70 cm uplink and 2 meter downlink) analog transponders and system-wide telemetry. The devices have worked very well after some initial difficulties with one of the onboard receivers.

The German portion of the package has yet to be fully exercised, but some of the experiments have provided surprising results. Not only has the satellite been heard speaking plain English text, but it has also been configured to act like a crossband FM repeater. Current undertakings include high-speed data transmission and a form of voice mail.

Known as RUDAK-2, for Regenerative Umsetzer fur Digitale Amateurfunk Kommunikation, or Regenerative Transponder for Digital Amateur Radio Communications, Version 2, the German apparatus has several possible configurations beyond those of earlier ventures. RUDAK-1 went to space with AMSAT-OSCAR-13. Due to a mixture of problems, it has not worked. It was to be a purely digital communications transponder and was quite simple compared to RUDAK-2.

FM Repeater in the Sky

In addition to the digital functions of RUDAK-2 shown in Table 1, the system can appear to operate in an analog fashion through the use of DSP (digital signal processing). Using the high-speed RTX-2000 RISC (Reduced Instruction Set Computer) processor in RUDAK-2 to produce speech from uploaded files or analog input from one of the uplink frequencies, the unit can send voice via an FM modulator. The uplink frequency is 435.016 MHz to a downlink of 145.983 MHz. It can appear to act just like a standard FM repeater, but it's all in the software.

Many stations discovered that it was a lot of fun to participate in 10-to-20-minute group conversations with participants thousands of miles apart using FM for both the uplink and downlink. During early tests, five minutes of each 10-minute period were set aside for the FM repeater mode. The other five were used for telemetry at 400 bps PSK. Later schedules only included one minute of telemetry for every nine of FM operation.

Doppler shift caused by the fast passage overhead was not a serious problem, due to the use of FM. The RUDAK receiver appears to be quite wide. Sensitivity of the system is not as good as the equipment on the Russian space station *Mir*, but most earth stations with 50 to 100 watts ERP (Effective Radiated Power) have been heard. Efforts to make contacts with less ERP on the uplink frequency are possible but very difficult.

Satellite Contacts on an HT

Using only a handie talkie, many stations have made contacts with one of the space shuttle missions carrying SAREX. HTs have worked with *Mir* on even more occasions. The amateur radio satellites typically use modes like CW and SSB and different bands for uplink and downlink. Some HTs, like the Santec LS-202A, can receive SSB, and many can transmit clean CW by keying the microphone line, but there are currently no multimode, dual-band handhelds.

When FM was activated for both uplink and downlink on A-O-21, many stations got on the air with anything available that could hear FM on 2 meters and provide FM output on 70 cm. The 145.983 MHz downlink is quite clear when heard on 145.985 MHz by a receiver with 5 kHz tuning increments. For the 435.016 MHz uplink, transmitters set to 435.015 MHz did well when used with directional antennas or power levels over 50 watts. Dual-band HTs using normal "duck" antennas and power levels below 5 watts can usually hear the 2 meter downlink very well, but have little chance of getting into the transponder without some help.

While in Austin, Texas, for a recent hamfest, AMSAT Vice President of Operations Keith Pugh W5IU was explaining satellite tracking to observers at the AMSAT booth. He was using A-O-21 as his sample satellite since many could copy the signals on their HTs simply by stepping out to the parking lot and listening. The example pass this time went directly overhead. It was a good candidate for experimentation.

On previous occasions I had made contacts through A-O-21 using relatively simple systems, but all had been with home antennas, portable beams or with amplifiers and large mobile whips. Those aids were not available on this trip to Austin, but the pass was a really fantastic opportunity to try for a contact. The high elevation (overhead) meant the distance to the hamsat would be less than a thousand miles at closest approach.

It worked. About halfway through the pass, KB8KVY in Cleveland, Ohio, was checking for weak signals and other hams who might want to join in the round-table discussion passing by in space. After several attempts using an Alinco DJ-580T, I could hear my own voice through the earphones. I had them on to avoid feedback and was also using an external microphone to allow quick repositioning of the HT for best received and transmitted signal while talking. An unsuspecting VW bug was used as a reflector to enhance the signal levels. Several transmissions from my HT satellite station could be heard quite clearly, with some white noise, through RUDAK-2. QSO information was exchanged with KB8KVY and congratulations were passed around at the Austin end of the contact.

Photo A. Andy WA5ZIB completing a contact via AMSAT-OSCAR-21 using a dual-band Alinco HT. (Photo by N5EM.)

There were several keys to the success of the contact. The satellite was at its closest point to my location. The antenna was a long dual-band type. I was using the Diamond RH77B (15 inches long). Power output was 5 watts on 70 cm. Received signal levels measured several S-units on the 2 meter side. A car was used as a reflector to enhance both uplink and downlink. Earphones and an external mike were incorporated. A little luck and a patient KB8KVY helped dramatically.

HT Modifications

Most dual-band HTs sold in the U.S. do not transmit below 440 MHz without modification. The Alinco is no exception. The manual that comes with the radio describes a modification to allow reception of aircraft AM signals down to 108 MHz. This requires cutting a red wire located just inside the metal baseplate at the bottom of the radio. The modification does not mention the blue jumper in the same area. To allow the radio to transmit outside the 440-450 MHz range, this blue wire must be removed or cut in a fashion identical to the instructions referring to the red wire. Both wires are easily identified since they form large loops just asking for the application of wire cutters.

After the target wire or wires have been detached, the unit must be reassembled and reset. To achieve this and enable the desired features, the "function" button must be pressed while turning the transceiver on. The LCD display will momentarily display all available digits and modes, and when the function button is released they revert to a normal display with 145.00 on the VHF side and 445.00 on UHF. The radio is now ready for A-O-21 operation.

Most stations that have used the DJ-580T for satellite work employ their home-station beam antennas or amplifiers for the 70 cm uplink. Although it is possible to make contacts on the system described above using only a long "duck," it is not easy and it will not yield many contacts. However, it proved a point: It can be done.

In a few years cellular phone operation will be available via low-earth-orbit satellites like Motorola's proposed Iridium constellation. Their system is designed to use 77 satellites. The "cells" (satellites) will orbit the earth keeping at least one over every location in the world. Until then amateurs can lead the way with inexpensive radios and innovative hamsats like A-O-21.

The AMSAT Annual Meeting and Space Symposium

AMSAT North America is getting ready for its Annual Meeting and Space Symposium. This year's event will be held at the international headquarters of Intelsat in Washington, D.C., over the weekend of October 9th through 11th.

Activities will begin Friday afternoon with registration, tutorials and a special AMSAT/ARRL education workshop. A full schedule of presentations ranging from talks for beginners to highly technical items dealing with the Phase 3D project will continue through Saturday.

The Saturday evening banquet will be followed by award presentations and a question-and-answer session

Continued on page 54

RTTY LOOP

Number 16 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Entry Level Question

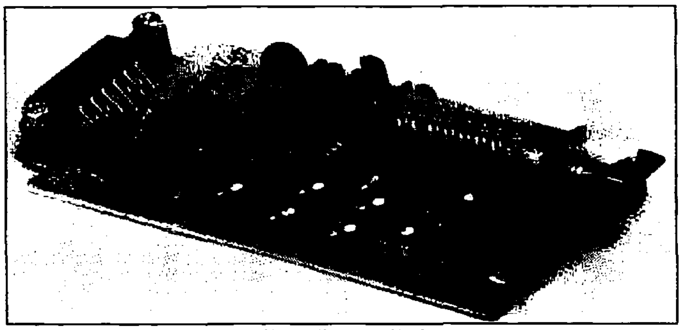
Digital modes may be all on and off, but the levels of understanding are clearly all in variegated shades of gray. I received an inquiry via CompuServe from Kevin Cornwell N6ABW dealing with packet. He relates being at a friend's house and seeing packet demonstrated lor the first time. He'd like to tinker and get onto the mode. He has an Atari XL/XE computer, and the know-how to use the stuff, but no idea what the packet protocols are. Kevin wonders if he needs to write his own software, and make up interfaces, so he feels he needs to know it all.

Well, Kevin, you may be trying to reinvent the wheel. The packet protocol is composed of discrete "packets" of data, each packet containing a header with addressing information, data itself, and error-checking information in a precise scheme.

Putting the software together to handle the data exchange and handshaking is no mean feat, and many programmers have worked long hours to produce tight code that satisfies today's demanding amateur. Take my advice, don't even try, at least not now.

Use the Atari as a terminal, running just about any communications protocol you have for telephone communications to talk to a dedicated packet or multimode controller. For all intents and purposes, the AEA, Kantronics or MFJ units are all comparable; choose by personal preference, features, and bells and whistles. Later, after you've been on the air for awhile, you might try your hand at writing some dedicated software. Who knows, you might even turn up someone else who has already started such a project. But for now, if you want my advice, keep it simple!

As to the details of the packet protocol, we have covered this topic at length in past issues of "RTTY Loop." If you would like to see this Information again, or for the first time for newcomers, or would like more on this topic, please drop me a line via any of the channels described below, and I will be happy to comply.



The MFJ-1271 TNC.

New Commodore TNC

For Commodore 64/128 users, MFJ has come out with an inexpensive packet solution, the MFJ-1271 TNC. This low-cost, one-board unit plugs into the Commodore's rear cassette port. Working both VHF packet at 1200 baud and HF packet at 300 baud, all you will need to get on the air is the computer, a transceiver, and the MFJ-1271.

A high performance modem/TNC with integral DCD circuitry and an adjustable threshold control allows the unit to reduce the noise susceptibility which so often troubles communication on the HF bands. Remote packet operation, message forwarding and Net/ROM emulation are also features of this inexpensive unit. The driving software is the Digicom/64 program, available from many sources, or lrom MFJ separately as their MFJ-1293.

Oh, the price! This little wonder is available from MFJ for "only" $49.95. They want $5 more lor the software, and that's got to be a good deal, too. Contact any MFJ dealer, or MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762, toll-free order line 1-800-647-1800. Do I have to remind you to tell them you read about it here, in *73 Magazine*'s "RTTY Loop"? I thought not.

Old Commodore TNC

I received a letter from Archie MacLellan VE1CEL of Antigonish, Nova Scotia, with a different twist on a problem. Archie relates that he now uses a PK-232 with a Commodore 64, and is planning to trade up soon to a PC compatible. Over the last few years he has acquired other terminal units, including the AEA CP-1 and HAL CRI-100. He used these units with either Kantronics Hamtext or AEA MBA-TOR with the Commodore C-64.

Now that he is moving up to a PC compatible, it seems there is no software to use with these terminal units. The CP-1 and the CRI-100 are from the era before the PC was the norm in computers, and it seems that no one has written a commercial program to use them with the PC family of computers.

Archie is looking for some soltware to use these units with PCs. Has anyone out there in RTTY land worked such a transformation? It would seem straightforward enough, presuming interfacing and protocols can be worked out. Let me know, and I'll pass the information on to both Archie and the interested readers of "RTTY Loop"!

Software Available

Speaking of low-cost software, the "RTTY Loop" software disk remains available. Containing a collection of public domain and shareware ham programs lor the IBM PC compatible family of computers, this disk is updated whenever I find something new to put on it. All you need to do to receive the information is send me a blank disk, either 5.25" or 3.5", a self-addressed *stamped* disk mailer, and $2 in US funds, all mailed to the address at the top of this column, and I'll turn the disk around and mail it back to you. Now, there is enough material to just about fill a 1.44 Mb high density floppy. So, if you send me a 360 kb floppy, you will get less "stuff" than sending me a high density floppy. I don't mind it if you send two low density disks; I'll fill both of them with different programs. But I've got more than a meg of software to send, so the more media space you provide, the more material you get.

Speak to Me

I have enjoyed the torrent of your comments received through CompuServe, America Online, and Delphi. Many of your requests and observations will be finding their way into future columns. Please keep them coming; I enjoy and read every one, and try to answer the messages as soon as I can. Address e-mail to me on CompuServe via ppn 75036,2501, on America Online to MarcWA3AJR, and on Delphi to MarcWA3AJR. Those desiring to use conventional paper mail can, of course, address correspondence to the address at the top of this column.

I have posed several questions over the last lew months about possible topics to be included in luture "RTTY Loop" columns. I mean it, I really do want to hear what you have to say. Drop me a card, letter, or e-mail, and express your opinion. At least here, your vote really *will* count!

Hamsats *Continued from page 52*

with the new AMSAT Board of Directors. Other activities are being planned for Sunday.

Registration forms are available from AMSAT headquarters. Call (301) 589-6062 or write to AMSAT, 850 Sligo Ave., Suite 600, Silver Spring MD 20910. Talk-in frequencies in Washington include 146.955/355 MHz and 224.94/223.34 MHz. This is a fine opportunity to spend time with the family in the nation's capital investigating our past while looking into the future of the amateur satellite program.

Regenerative Transponder RUDAK-2

Uplink	RX-1	RX-2	RX-3a	RX-3b	RX-4	Unit
Frequency	435.016	435.155	435.193	435.193	435.041	MHz
Speed	1200	2400	4800	9600	DSP	bps
Modulation	FSK	BPSK	RSM	RSM	any	
Coding	NRZIC BI-0-M	Bi-0-S	NRZIC BI-0-M	NRZI NRZ-S+scrambler	I+Q	

Downlink: 145.983 MHz with 3 watts typical (10W optional)

Mode 1:	1200 bps, BPSK, NRZI (NRZ-S) (like FO-20)
Mode 2:	400 bps, BPSK, Bi-0-S (like OSCAR-13 beacon)
Mode 3:	2400 bps, BPSK, Bi-0-S (planned for OSCAR-13)
Mode 4:	4800 bps, RSM, NRZIC (Bi-0-M)
Mode 5:	9600 bps, RSM, NRZI (NRZ-S) + Scrambler
Mode 6:	CW keying (only for special events)
Mode 7:	FSK (F1 or F2B), i.e. RTTY, SSTV, FAX, etc.
Mode 8:	FM modulated by D/A signals from DSP (speech)

Table 1. Configuration of RUDAK-2 on A-O-21.

Photo B. The Alinco DJ-580T set up for full duplex, FM crossband operation via A-O-21.

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

10 GHz WBFM Transceivers Q & A

I have received numerous questions concerning the 10 GHz Solfan Gunn oscillators and other similar types of units. The questions all focus on different oscillator cavities and the adjustments required to put them in operation in the amateur portion of the band near 10.250 GHz. These commercial units as stock operate on 10.525 GHz and must be lowered in frequency to make them usable in amateur service. This information was published several years ago, but it needs repeating again due to continued interest and new units appearing on the surplus market.

The first question comes from Dick KM6PA, "Do you have reprints of the '10 GHz Fun' article, April 1990? I recently purchased two Solfan intrusion devices." Dick states that he was fortunate enough to get the entire unit, and when it is powered up the red LED indicator on the unit comes on. Passing his hand in front of the waveguide horn antenna causes the LED to come on and then go off again after a short interval. What is the application?

Well first, yes Dick, I have reprints of "10 GHz Fun" and include them with the system PC board kit/30 MHz IF amplifier for Gunn transceivers that I make available. Also, check with *73* for articles in back issues on this, and other articles you may have missed. Cost is only $3.95 per back issue, if available. Article reprints are $3.00.

Secondly, concerning your question on the alarm units and its LED operation, the Solfan-type alarm units were originally intended for motion detectors for the alarm industry. Motion was detected and transformed into an audio tone to activate the alarm unit circuitry: LED dark, no alarm; LED on, alarm/motion detection.

The return audio tone that is received is interpreted by the alarm unit as something in its path of radiation and activates a relay in the unit for an alarm condition. Part of the reason these units were junked is false alarms which can be caused by "large bugs, moths, etc." flying into the microwave beam, or people walking outside a building near an interior microwave unit. The units could "see" through some walls. False alarms in the alarm industry have led to more reliable units, hence the dumping on the surplus market of these microwave burglar alarms and motion sensors. They are being replaced by infrared systems, or combination systems.

Another interesting relationship exists between microwave units and radar speed detectors (they are quite similar). If you take a transmitter and point it towards some distant traffic (automobiles) and connect your phono amplifier to the detector, you will be able to listen in to the "radar" function. What happens is that the receive tone is shifted in frequency due to the motion of the target, and is representative of the object's speed. The return transmitter frequency is shifted approximately 130 hertz for each mile per hour of the object speed. For example, at 10 MPH, the return tone would be about 1,300 hertz, or cycles if you prefer. Coupling the transmitter receiver to your phone amp is one application to demonstrate a simple "radar" application of microwave. See Figure 1 for the Doppler radar setup.

Ed Reidell, N. Versailles, Pennsylvania, questions an old *73 Magazine*, October 1986, article titled "Microwave Building Blocks for the IF Amplifier." The article covered a TDA-7000 single-chip receiver that could be used in conjunction with a WBFM microwave transceiver. Ed questions the use of this same IF system in construction of an FM receiver for higher frequencies like 2 meters and above. Could it be equipped with suitable converters using the TDA-7000 chip receiver, as in an IF amplifier?

Yes, Ed, the chip will work in this application. The TDA-7000 chip can work to about 120 MHz without converters. It was originally intended to be a commercial band FM receiver, 88 to 108 MHz. To extend operation to a higher frequency I suggest the NE-604 and NE-602 converters from National Semiconductor. Their use in front of the TDA-7000 would extend operation into the UHF region. Other alternatives would be the transistor converters found in almost any issue of the *ARRL Handbook*, VHF/UHF chapters.

Ed's and Dick's questions are typical questions I receive concerning microwave and the IF system using the TDA-7000 30 MHz IF amp, and Solfan-type systems in general. Let me expand on some of these questions and other points of interest covering the whole system package that can make operation on 10 GHz quite inexpensive.

Solfan Units

The typical Solfan-type units should not be expensive. The surplus units typically cost about $25. A new Gunn diode transceiver (similar to the Solfan) is available from EMCOMM Industries, and the cost is just under $50 (that's brand-new).

These cavities differ in construction from the Solfan-type by being quite a bit smaller. See Figure 2 for cavity details. The cavity incorporates a detector diode positioned off-center in the waveguide (WG-16). The Gunn diode is on center, located just behind the detector. In front of the detector is a small piece of ferrite that appears to act as a circulator. This device will have to be tested, but it looks quite good. Ed Emich N2NPR of EMCOMM Industries will stock these units provided there is sufficient interest in them; cost per unit is $50. Contact Ed Emich at EMCOMM Industries, 10 Howard St., Buffalo NY 14206; phone: (716) 852-3711. Cavities such as these are quite simple but popular, due to their low cost, in WBFM applications for 10 GHz operation.

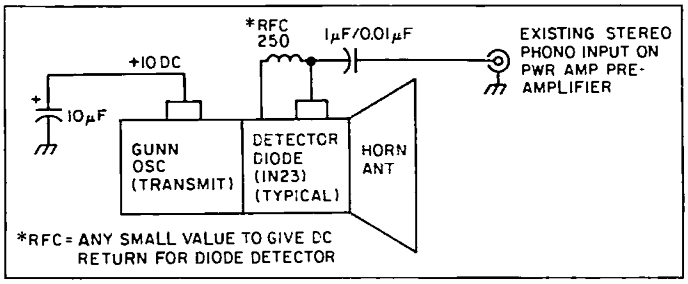


Figure 1. Simple Gunn Doppler "radar" motion detector. Audio tone equals approximately 130 Hz per MPH.

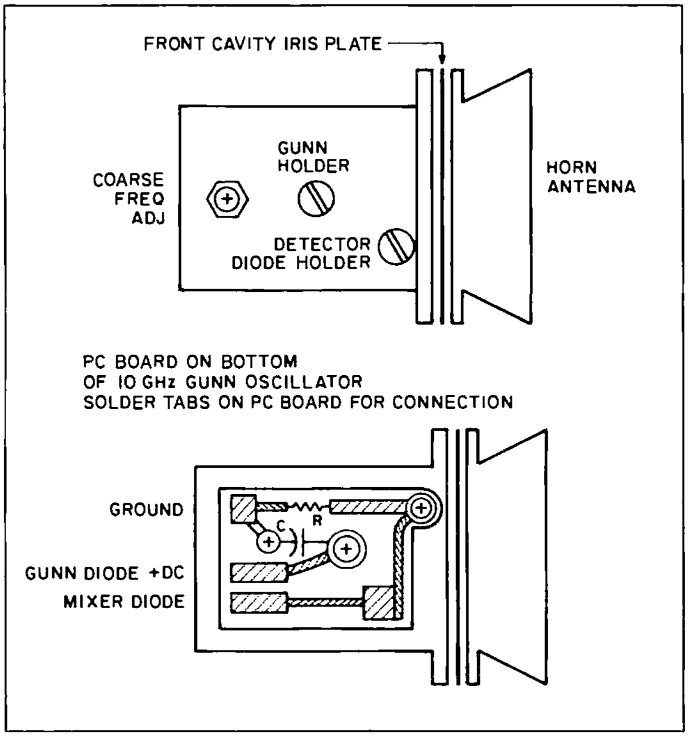


Figure 2. Drawing of the EMCOMM Industries cavity (see text).

The top-of-the-line unit that is available for WBFM on 10 GHz is the Gunnplexer™. This unit is manufactured by Microwave Associates and costs about $150 each for their varactor-controlled Gunn oscillator/detector assembly. This cavity design incorporates varactor frequency control, which operates quite well, giving some 90 MHz frequency variation. Voltage is varied on the varactor for frequency tuning and keeping the Gunn voltage fixed, making for high stability.

By comparison, the Solfan-type units are simple and inexpensive; conversion to amateur frequencies is just an adjustment away. Coarse frequency on all units is set similarly by a mechanical adjustment screw. On the Solfan unit, this is the only mechanical adjustment possible. Further Solfan frequency adjustment is made by varying the Gunn diode voltage between 7.5 and 10 volts for a corresponding frequency change of about 5 MHz. (Fine frequency is set at 9.5 volts, with the coarse adjustment mechanical screw used to set the frequency desired.)

The Solfan detector is connected to an IF amplifier for receive and the Gunn diode (transmitter) is modulated by a simple voltage regulator type modulator. That's all that's needed to construct a 10 GHz WBFM transceiver. The IF system can be any IF strip that is convenient, such as an old FM radio converted to a lower frequency or used as is. I prefer to use 30 MHz in the system I developed, using the application notes from Signetics on their single chip FM receiver. The result was the receiver system described in "FM Fun" and the earlier "Microwave Building Blocks" article.

In those articles, the system IF board was developed to support either the Microwave Associates Gunnplexer™ or a simpler surplus motion detector like the Solfan. The PC board IF amplifier has 5 microvolts sensitivity at 30 MHz, and when used with a preamplifier, puts the total IF sensitivity near 0.2 microvolts. The system board also contains the power supply modulator circuitry for the Gunn diode. This type of modulation can be changed when using the Gunnplexer units by switching the modulation to the varactor instead of the Gunn diode, as used in Solfan-type systems.

For those considering using these alarm-type microwave units in amateur

applications, they can be made to work well with little effort. The main item used from the motion detector is the metal microwave cavity. Everything else can be discarded. Couple with the basic microwave head, which can be obtained as surplus, or use a new unit offered from EMCOMM. All you need to finish a system is to add a simple 30 MHz IF system. This unit incorporates not only the receiver but the power supply modulator to complete the 10 GHz transceiver system for WBFM. For amateur use, scrounging is paramount, and getting a simple rig operating on microwave for little cost can be very attractive.

Getting back to the Solfan cavity, some of the questions that have come in from time to time are mainly concerned with the pinouts and screw adjustments that are part of the basic cavity. Larry K1LPS made a drawing covering this very subject, I have included it as Figure 3. There are single cavities with only a Gunn diode. The dual cavity is identical with the single cavity in all respects; it just omits the detector diode portion of the cavity.

Single cavity systems can work as transceivers but are not as sensitive as the dual unit with the detector diode. In the single unit a self-detect type of operation is going on using the Gunn diode for both transmit and receive. It works but lacks sensitivity. Units that have a separate detector diode are more sensitive. The RF output of either unit is normally coupled into a small horn antenna.

Another question that arises concerns defective Gunn devices. To this end I have supplied some replacements that are suitable for the Solfan cavity. These are not suitable for use in the Microwave Associates cavity due to the case style of their device. The diodes that I obtained have a 3/48 thread mount on the heat sink side of the diode and are about 0.2 inches long. The usual method to mount them is to drill a hole in the end of a brass 10/32 bolt and tap for 3/48 to thread the Gunn device into. If your cavity will take this type arrangement then it will work. See Figure 4 for case styles.

The main purpose of these notes is to provide guidelines on how to use the Solfan motion detector or other similar units as a Gunn transceiver for 10 GHz. The basic Solfan unit has a horn antenna that has a gain of 10 to 11 dB gain and a beam width of 50 to 60 degrees. Removal of the metal cavity with the associated components attached to it from the alarm unit is all that is needed. See Figure 3 for Solfan cavity details (it provides you with all the information on what each adjustment screw is for).

The frequency of these units as they come from the factory is set to 10.525 GHz. Frequency setting to the proper or usual amateur frequency is the toughest part of conversion due to a lack of frequency setting equipment in most ham shacks. This equipment is quite expensive and can be damaged by high levels if not used properly. That's why most hams who have them don't loan them. Possible ways to set frequency are to compare it to another working unit or to get a microwave wavemeter from surplus for frequency setting applications. If you have one and are unsure of its calibration, I will "for the cost of postage" re-calibrate surplus wave meters sent to me. The normal frequencies we usually calibrate include 10.230, 10.250, and 10.280 GHz, the standard WBFM 10 GHz frequencies.

Note that the spacing of frequency is exactly 30 MHz, the system IF frequency. These units operate full duplex and both ends of a communication path have their respective transceivers set to a frequency 30 MHz apart from each other to communicate. The transceivers use their transmit frequency as the local oscillator for receive injection. This produces the IF frequency difference of 30 MHz in this case. A 30 MHz difference for an IF is not sacred, as any standard agreed-upon frequency can be used. The trick here is that both stations must be offset by the same frequency to communicate full duplex. Well, that's it for WBFM Gunn units for this month. Hope this note helps expand information on your system.

Mailbox

Bill Notine K6HH writes that he enjoys the column and uses it to keep up with progress in microwaves and the other amateur applications presented here. He worked in microwave development during WWII and later for Raytheon Electronics before opening his own business. Bill states that he has a lot of interest in microwave technology and tries to keep up with new developments. Bill's been working on digital modulation and has published part of his work in the June and July 1988 issues of *73*. One question that Bill asked me which I was unable to answer concerns "BASS," or Bulk Avalanche Semiconductor Switch. Well, Bill, that's a new one on me, I can only speculate on what the application is. I suppose by the name and nature of GaAs (Gallium Arsenide) or some other semiconductor in an avalanche state means that we have a very low loss high current switch which is much better than any transistor or FET currently available.

I might be way off base, but would conclude that it might be a device that would replace high power VMOS FET switches. These devices can switch very high currents and high voltages in speeds in the nanosecond range. One V-MOS device that I am familiar with is the IRFP-140, which can switch 100 volts at some 140 watts dissipation. The trick with these types of devices is that the drain-to-source resistance of the device in the "ON" state is in the order of an ohm or less! That means lots of current and little device junction heat to dissipate, hence high efficiency. In the "OFF" state the drain source resistance is in the megohms, really off. Does anyone know for sure what a BASS is, besides a fish? Am I on track or way off base? Let me know. Bill's Hotine address is 633 Ramona Ave. #23, Los Osos CA 93402.

Joe Johnson WB8RDY, 2312 Cunninghan Dr., Opelika, Alabama 36801, needs information on several TWTs he recently picked up. Joe is in need of information and schematic diagrams for the devices. What Joe picked up were Alfred Electronics Model 5302, and a TWT tube from GE-type GL-7393. The second unit was mounted in an Alfred Model 503. Sorry Joe, I tapped out in my information stock pile. Most of the Alfred information that I have lists TWT amplifiers and sweep plug-in units with model numbers in the 560 range and sweep plugs in the 650 range. Anyone have anything in their shack to help Joe out?

Ellis W4ILY, who has obviously kept back issues of *73 Magazine*, asks, "Is the PC board and parts still available for

Continued on page 60

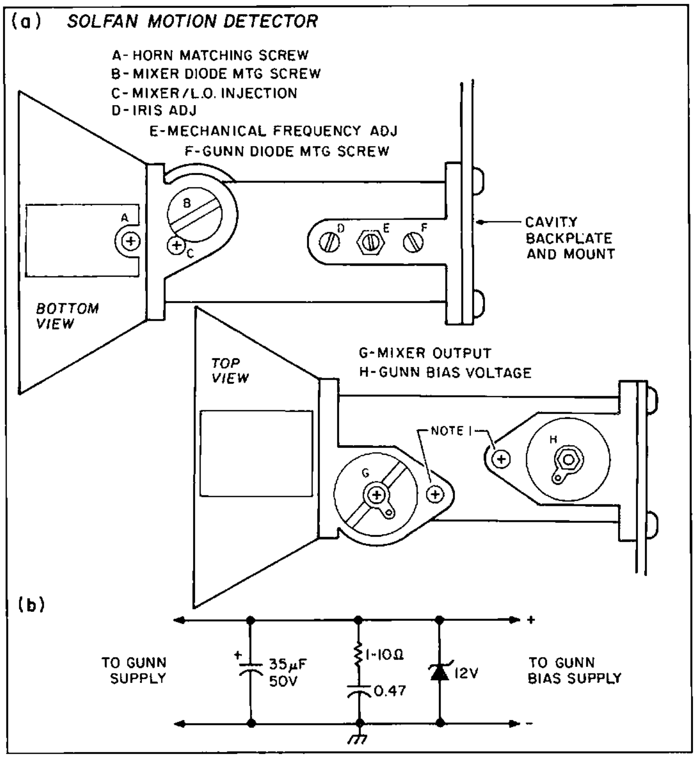


Figure 3. Typical Solfan cavity design adjustment/DC feed locations. a) Note 1: There is a cluster of parts attached to these two screws, one of which is a ground lug and the other insulated. See text. Note 2: All adjustment and mounting screws use a liquid lockwasher compound. Use moderate heat and/or suitable solvents to clean these. Use caution when removing so as not to break off these screws. b) Recommended Gunn protect network (see text).

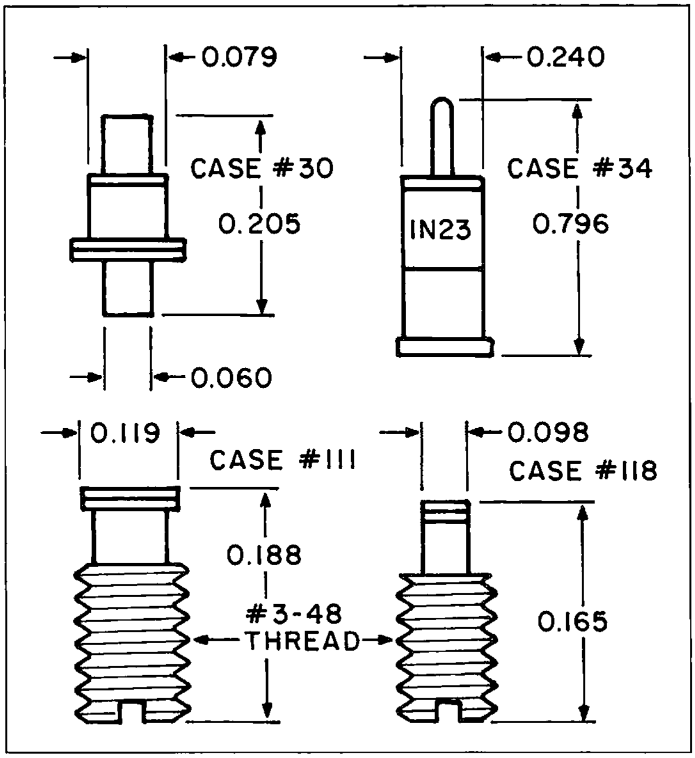


Figure 4. Various case styles for microwave diodes, detectors, and Gunn devices. All dimensions are in fractional inches.

Number 18 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

Have a quick 'n' easy circuit idea? Share it and get a one-year subscription or extension to 73! Clearly mark all entries as submissions for "Circuits" to distinguish them from manuscripts. Send your entries to Circuits, *73 Magazine*, Route 202 North, Peterborough NH 03458.

AC Line Voltage Monitor

My shack is in an old house in a very old neighborhood. Instead of the AC service being 220-VAC split phase, only 110 VAC is brought into the house from the pole transformer. While mine is a "worst case" example, your line voltage will vary from its nominal 117 VAC, sometimes a lot. This is especially true during "brownouts" when everyone is either cooking with electric ranges, or using electric heat or air conditioners. It is also true when you are using a lot of power in your home, including that you use in your shack. It is advantageous to be able to monitor the line voltage, but most commercial voltage monitors, even those occasionally illustrated in ham magazines, represent an outlay of many precious dollars. Most hams are unwilling or unable to spend such a sum merely to keep track of their line voltage.

The simple AC line voltage monitor described in this article can be put together from just about any junk box, without spending a cent. Even if all new parts are purchased, the total cost should not exceed $3.

The circuit of this voltage monitor is shown in Figure 1. Two diodes, a capacitor, a small potentiometer and a DC meter of any size up to 10 mA full-scale are the only parts you need. As shown, my monitor measures from 90 VAC to 130 VAC over the entire scale of the old 500 mA meter I pulled from my junk box. You can easily change the range of voltage displayed merely by changing the value of, or eliminating, the capacitor.

I chose to spread a 40-volt range over my meter simply because the meter is a plate meter from an old Gonsett amplifier with a scale of 800 mA, but the basic movement is 500 µA. The 0.01 µF 150 VDC capacitor I used sets this 40-volt range, and the series resistance of the potentiometer established the voltage at the former zero end of the scale. Eliminating the capacitor provides a voltage range of 10 volts over the entire meter scale. However, because the line voltage here varies from about 105 to 122 volts, I decided to set my meter up to indicate a wider voltage range.

In operation, the 1N4007 acts as a half-wave rectifier and is fed directly into the cathode of zener diode 1N4764A, which is rated at 100 volts and 1 watt. This drops some voltage, and the potentiometer sets the beginning of the range of voltage to be monitored. Its value depends on the basic meter movement. One of the small surplus edgewise meters, usually 100 µA or 200 µA, is ideal, and most of us have several in the junk box. However, a larger meter enables closer measurement. The capacitor acts as a poor filter and its value determines the range of voltage over which your meter will indicate. This capacitor should have a working voltage of at least 150 VDC, but otherwise it is noncritical.

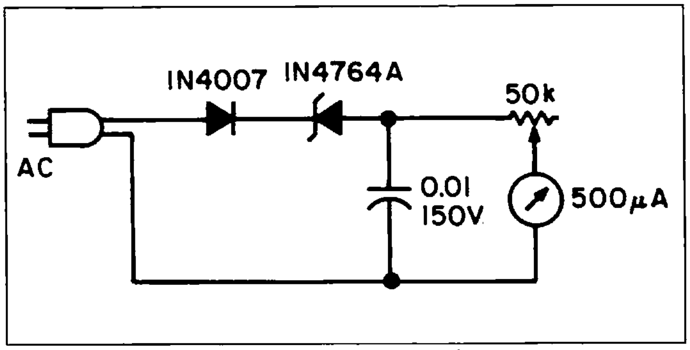


Figure 1. AC line voltage monitor.

Most surplus mail order dealers will have the parts you need at reasonable prices. However, go through your junk box first. Chances are you won't have to spend a cent to have an accurate line voltage monitor.

For Field Day or emergency operation using a motor-generator to supply AC power, this line voltage monitor will prevent accidental over- or under-voltage from being supplied to your expensive ham equipment.

To ensure accuracy of your monitor, use a digital voltmeter to measure the line voltage when adjusting your series potentiometer. Adjust the pot so your meter indicates the same voltage as the digital voltmeter. When choosing the potentiometer, remember that a 5 mA meter requires 200 ohms per volt; a 1 mA meter needs 1,000 ohms per volt; a 200-µA meter uses 5,000 ohms per volt; and a 100-µA meter needs 10,000 ohms per volt. Because the current through the meter is so low, a miniature trimpot will serve the purpose adequately.

The voltage set by the potentiometer is *not* the AC line voltage, it is the voltage range you choose to spread over the entire meter scale. As an example, my 500 µA meter required about 40,000 ohms, so I used a 50,000-ohm trimpot set at about 40,000 ohms. All parts can be mounted on a terminal strip fastened to one of the meter's mounting screws.

I just checked my monitor. I have almost 115 VAC! I hope you do a lot better!

J. Frank Brumbaugh KB4ZGC
Bradenton FL

Above & Beyond

Continued from page 58

the TDA-7000 IF system ("10 GHz Fun," October 1991)?" Yes, while the TDA-7000 chip proved to be difficult to obtain as new stock (my distributor was out of stock), I have received several tubes of TDA-7000 chips and have the PC board available. The cost is the same: $10 postpaid for the PC board, ready to drill, with a TDA-7000 chip. I usually toss in a few caps and other parts that can be used in each project, gratis.

Other kits available include the CW EPROM IDer for $12 postpaid. This kit comes with a programmed EPROM, such as "De Your call/B," or just your call. It was intended for use with the 10 GHz transceivers to run audio modulation on your WBFM transceiver while aligning or serving as a beacon mode of operation. A real "voice saver."

I still have quite a few 50 and 100 mW Gunn diodes, case style #111 and #118, that are 0.2 inches high, with 3/48 threads on the threaded heat sink negative terminal of the Gunn diode. The cost is $5 for a 50 mW device and $10 for a 100 mW Gunn devices. I still have a few 100 mW devices left but they are getting harder to test out. I do have brand-new low current—approximately 25 mW—devices for $10 each postpaid. These just came in. I always try to obtain hard-to-locate microwave components when I can find them as they tend to be hard to find and not available on a regular basis. The case styles of all Gunn devices are #111 & #118 (3/48 thread mount on heat sink portion of Gunn device, negative supply terminal).

Ellis comments that he has been licensed since 1941 and this will be his first activity above 440 MHz. He requests additional information on reading material and other related information. He picked up two Gunnplexers at Dayton but they did not have any horn antennas. Can you suggest a source of reasonably priced horns? Ellis, I don't have a source but I suggest you construct one as they are quite easy and very forgiving on dimensional errors and still work well. I will provide a folding pattern for a horn for 10 GHz next month.

Well, that's it for this month. As always I will be glad to answer questions covering microwave and related topics. For a prompt reply please send an SASE. 73 Chuck WB6IGP

Parts List

1 Plastic box, type used to mount switches and outlets in.
1 Duplex receptacle.
1 115-volt relay with normally open contacts.
1 Line cord long enough to reach from wall outlet to timer.
1 Short piece of line cord to reach from the inside of the box to the timer outlet, 8 or 10 inches long, with a plug on the end to plug into the timer.
1 Neon pilot light, 115 volt,(so you can tell that the charger is on).
1 Normally open push-to-start switch.

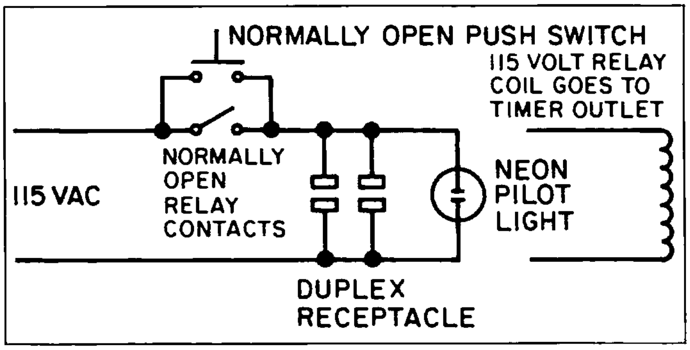


Figure 2. Timer controller.

Timer Controller to Protect Your NiCd from Overcharging

The instructions that came with my 2 meter HT call for a recharge time of 14, but not over 15, hours. My first thought was to use one of those 24-hour timers that turn lights on and off in your house, but in nine hours or so this type of timer turns back on again giving a second, unwanted, recharge. Here is a circuit that will prevent the timer from turning on again. See Figure 2.

Plug the timer and the device to be timed (charger) into the duplex receptacle. The output of the timer itself goes to the relay coil. A short cord coming out of the mounting box (and just long enough to reach the timer outlet) takes care of this.

Set the timer to the number of hours you want to charge (some things call for less time). Turn the timer to ON, then, with everything plugged in, just push the push-to-start switch to start the charging process. When the timer shuts off, the charging stops and you can forget about an over-charge. In the case of a power failure, all you have to do is push the start switch and the system will finish the charge. See Figure 2.

Orville Gulseth W5PGG
Minnetonka MN

Noise Reduction Using Broadband Active Whip Antennas

Continued from page 40

your system working properly, a complete null of the signal should occur when the phase and amplitude of each channel are equally balanced.

This phasing unit is part of a system approach to improved long-wave reception. The combination of other benefits, as mentioned earlier, should be seriously considered for the best possible reduction in noise and enhancement of the desired signal.

Conclusion

It astonishes me how a simple system such as this can be so effective when dealing with problems such as noise, and help to open up opportunities for radio communication in the low frequency region. This system could probably be used with loop antennas and perhaps even more elaborate circuitry that would provide unusual types of reception patterns for further reducing noise and/or unwanted signals.

Some parts sources for this and other LF/VLF projects are:

LF Engineering, 17 Jeffry Road, East Haven CT 06513

BURHANS Electronics, 161 Grosvenor St., Athens OH 45701

Curry Communications, 852 N. Lima St., Burbank CA 91505

Ken Cornell's "Radio Scrap Book" Sixth edition, pg. 9.

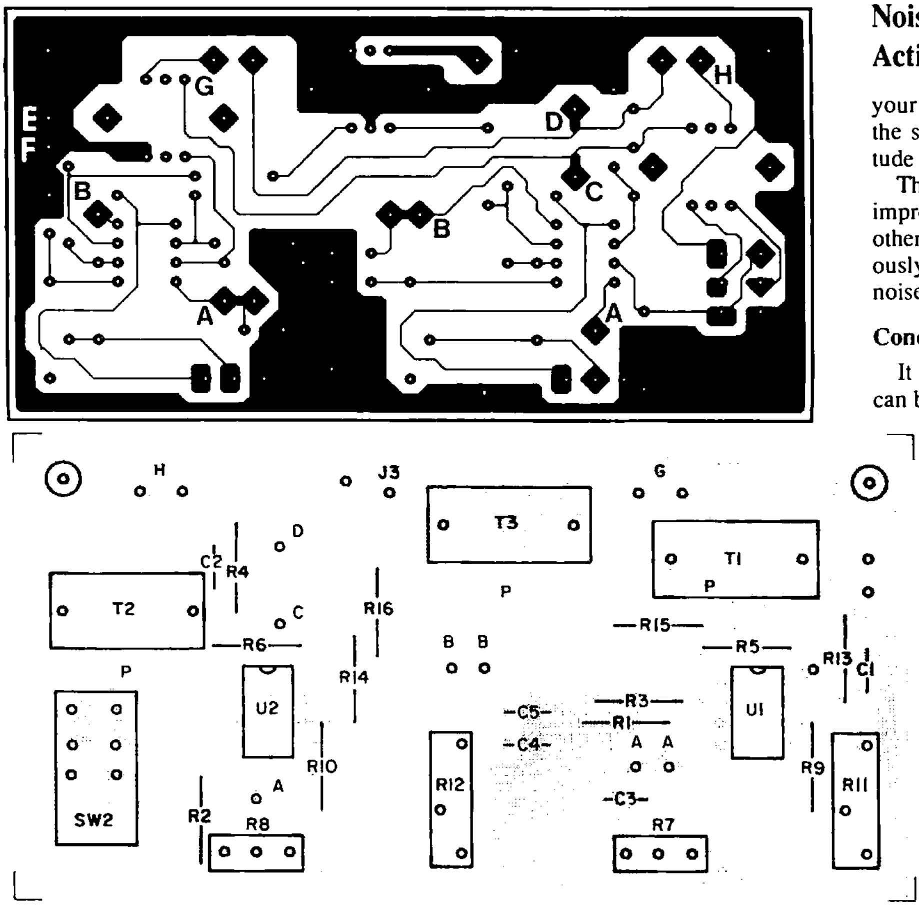


Figure 5.(a). PC board foil pattern for the phase unit. (b). Parts placment.

The DAIWA DP-830

Continued from page 27

played completely or incompletely on LCD." Hmmmm. Well, at least I knew there was a RESET switch. I pored over the pictorial and found the switch, accessible through a screw hole in the bottom of the chassis. Sure enough, it corrected the problem, just like the instructions said.)

Another somewhat startling aspect of the instruction sheet concerns the final page. Most of the instructions are printed with each page split down the middle, Japanese on the left, English on the right. However, at the bottom of the last page is a box filled almost entirely with Japanese, and what looks like a spot to fill in the serial number, date, and other pertinent information. The only English text in this box is the statement "This warranty valid only in Japan." Hmmmm. I did notice a separate Warranty Registration Card, discussing a one-year limited warranty, ready to be sent to Electronic Distributors, Inc., in Virginia. I gave EDCO a call, and found: 1) some very friendly people; 2) that the DP-830 has a one-year warranty; and 3) that EDCO performs DAIWA warranty repairs right in Virginia—you won't need to take your wattmeter to Tokyo for repair, UPS can take it right to Virginia.

Not that that appears likely. The DP-830 looks like a unit that's well-built enough to last for years, and well-designed enough to make you want to hang on to it for that long. The DP-800 series is distributed by Electronic Distributors Co. of Vienna, VA, and is available anywhere DAIWA products are sold.

Number 19 on your Feedback card

PACKET & COMPUTERS

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First Things First

I want to start this month's column with a correction. Somehow, I managed to leave out a very important character in my instructions for AD8I's WP (White Pages) server. That character is the question mark that should follow the callsign being queried. So, here are the corrected instructions:

SP WP @ AD8I.#CMH.OH.USA.NA
QUERY (this is the subject)
call_1 ? <cr>
call_2 ? <cr>
...
call_n ? <cr>
^Z (control+z) <cr>
where:
<cr> is carriage return—enter on PC compatibles
call_1, call_2, etc. are the calls subject to query—more than one may be included, but be sure that each is on its own line, as shown.

Sorry for any inconvenience this error might have caused, and thanks to AD8I both for pointing it out, and for running the WP server as a service to the amateur community.

Internet Update

Boy, did I get a lot of mail about Internet access to and from packet. Lots of letters and e-mail, much of it with questions about going from the Internet mail system to AX.25 packet. Well, this is possible, but . . . the difficulty here is the amount of time required on the part of the administrator of the connection. In the case of AX.25-to-Internet, the gateway routes the traffic onto land lines. But, going the other way means that land line traffic ends up coming out of a radio, and the control operator of that transmitter needs to be concerned with what goes out over the air. This means that each message must be checked for legality, a tedious process to say the least. You can see why there aren't too many gateways in operation. I have used such gateways in the past, but I have been told these may no longer be operational. I plan to do some digging and report back here if I can find an Internet-to-AX.25 route. In the meantime, if any of you know of a path that works, please let me know! You can reach me care of this magazine, electronically on MCI Mail (jsloman), or CompuServe (71221,1143).

Portable Packet

Packet stations that can be moved around are particularly useful for emergency communications. Packet's potential to pass critical information to and from EOCs (Emergency Operating Centers) during disasters has not been well exploited. Why? A large part of the problem is planning. If the local ARES or RACES organization has not developed a packet network, it is unlikely that a disaster situation will bring about the miraculous cooperation of the area's packet users. Planning and *testing* of the emergency network is essential if it is to be useful when disaster strikes.

One thing the individual ham can do is to build a portable packet station that will be ready when needed. To be useful, a portable packet station need not fit in a shirt pocket or be built into a briefcase—though there is nothing saying you can't have fun building something like this. Let's look at the elements of a portable packet station, and some choices.

Battery Operation

During a disaster, commercial power may be unavailable for some time. This makes battery power critical. A low power (5W) packet station based on a handheld and portable computer can be run from a storage battery for quite a long time. There are several types of batteries suitable for this application. Here are a few:

Alkaline: These batteries have some obvious problems. They are primary, rather than secondary, meaning they cannot be recharged. They are used and then thrown away. They are costly, particularly when you consider their disposable nature. But, alkalines have some good aspects too, particularly for emergency service. They are readily available—there is almost nowhere that a set of D cells cannot be purchased. They are very high capacity, offering a long battery life, which somewhat offsets their high cost. They have an excellent shell life, and can be left sitting around for quite a long time and then pressed into service. Battery holders for the various sizes are readily available, making battery pack building easy. While I wouldn't suggest using alkalines as the primary power source for a portable station, having an alkaline pack as a back-up is an excellent idea.

NiCd: Nickel-Cadmium batteries, like those used in your handheld's battery pack, can be used for this type of operation. They have the advantage of an extremely high *power density*, the battery equivalent of power-to-weight ratio. Pound for pound, NiCds are one of the most powerful types of battery available. These otherwise excellent batteries have two negative points, though. First, they are finicky about charging and can be easily damaged by overcharging or overdischarging. They suffer from *NiCd Memory*, the tendency to lose the ability to charge to their full capacity if they are not routinely discharged. These qualities make careful maintenance of NiCds essential—particularly if most of the time they sit idle. In an emergency, they will be expected to work hard; will they?

The second obvious problem is cost. NiCds can be very expensive. If you happen to find some NiCd packs—in good condition—cheap, say, at a hamfest, it is probably worth using them. Keep in mind, though, that you will need to carefully charge—and periodically discharge—them to insure they will be ready for use.

Sealed Lead-Acid: Lead acid batteries are an excellent choice for portable emergency operation. Their main disadvantage is weight—they are substantially heavier than NiCd batteries of the same capacity—but their advantages make lugging the weight worthwhile. Generally speaking, there are three kinds of lead acid batteries that are useful for portable operations.

Gel Cells: The "gel" in gel cell refers to the gelled electrolyte used in these batteries. The acid is stored in the form of a gel, allowing the batteries to be mounted in various orientations without the possibility of leakage. Compare this to liquid electrolyte, as in a car battery. As with all the other batteries, there are good and bad things about gel cells. First, the good stuff: They are readily available. Since these batteries are used in all sorts of commercial applications—alarm systems, battery backup power, etc.—the surplus market is overflowing with them.

Careful shopping can turn up some good deals on these guys, but you must be careful. Gel cells do not take well to being fully discharged for long periods. A dead gel cell is probably really dead. The easiest and first test that should be done is to pick up the battery and shake it. If it rattles, it's probably good for a paperweight—but not as a battery. Carry a volt meter with you when you shop. If the terminal (no load) voltage is at least 7 volts, you can probably charge the battery. If it is less, give it a pass—you will find others. Another useful test is a 12-volt lamp (like a back-up light from a car) with a pair of leads soldered to it. This will allow you to test the battery under load.

If you find some good batteries at a good price—12V 5 Ah packs should cost from $5 to $15 surplus—treat them right. Gel cells require some care in charging. Never overcharge them or let them become discharged for extended periods. It is a good idea to buy or build a charger designed especially for these batteries.

Deep Cycle Marine: These sealed lead acid batteries are used on small boats for engine starting and electrical power. They produce impressive—and potentially dangerous!—currents. They are easy to charge, and quite forgiving about maintenance. You are unlikely to find one surplus, and new they will run you from about $50 to $80. While you will not want to carry this battery around, a station that will be set up in an EOC or other fixed location will run from one of these for a long time—even with a 15- or 20-watt transmitter.

Gates Cyclon: The Gates Cyclon battery is a unique lead acid design. It uses a special lead matrix instead of traditional plate design and comes about as close as you can get to a "dry" electrolyte. The design of these batteries makes them much less vulnerable to charging damage. Gates batteries are much less common than gel cell types, but you will still find them among the gel cells at hamfests. Unlike gel cells, Cylcons with zero terminal voltage are not necessarily dead in a permanent way. A high voltage (15-20V) at low current (30-50 mA) will rejuvenate a battery that does not want to take a charge. Normal charging of Cyclons is constant voltage; that is, 13.8V is applied to the battery at any current. The battery itself limits the current as it charges. Charging currents as high as 20 C (C= capacity of the battery in Ah or Amp Hours). This means, for example, that a 5 AH battery could be safely charged in less than 10 minutes if you could actually deliver 200 A at 13.8V to it. Practical considerations prevent this, but the point is: This battery can be charged by just about any regulated 13.8V supply. These batteries are not particularly lightweight, but they are manageable, even if they must be carried around. This is my battery of choice for emergency and portable operations.

Your Car: The battery in your car will make an excellent power supply—with a built-in charging system. If you intend to operate mobile, you could do worse than your car's electrical system.

The Terminal Node Controller

Obviously, portable operation requires a suitable TNC. Once again, while tiny is nice, it isn't absolutely necessary. The size must be manageable, but unless you intend to carry the station on foot, nearly any simple VHF TNC will do the job. In fact, current draw is more important than size. One way to limit the current required by the TNC is to choose one with a small memory size. The memory is used to store messages for the TNC's mailbox, and is really unimportant for a portable station since the mailbox is unlikely to get much use. The best way to determine if the TNC is appropriate is to try using it, portably, in a non-emergency situation. Field Day is an excellent opportunity to give the station a workout. You can also get some idea of the TNC's current consumption by checking the manufacturer's spec sheet.

My own portable station uses an HK-21 Pocket Packet TNC from Heathkit. While this unit is very small, which is nice, it does have some problems. First, power input is through a tiny coaxial jack mounted on the side. This is much more vulnerable than I would like. The data connection is through a 25-pin D connector on the back of the unit. The mating connector is nearly half the size of the unit itself. When checking out a potential TNC, keep these connections—and the connection to the radio—in mind. Remember that you will want to build a reliable set of cables (this is very important) for your station. Make sure the TNC's suite of connectors allow this.

The Data Terminal

A packet station needs some sort of

data terminal. A portable station needs something that will run from batteries. When I built my first packet station, the best choice was the Radio Shack Model 100. This is a notebook-sized computer with an eight-line by 40-character display. While this is a noticeable limitation, the Model 100 does have the distinct benefit of requiring very little current. The unit will run for about 20 hours of intermittent use on four AA cells. You will find many used Model 100 computers listed for sale on packet and at hamfests. The other Radio Shack computers from about the same era—the Model 200 and Model 600 computers—are also good portable terminals.

But today's notebooks and laptops are so much more capable that these older computers don't seem very attractive anymore. One popular machine from just a few years ago is the Toshiba T1000 battery-powered notebook computer. These units feature floppy drives and much better displays than the venerable Model 100. Powering some of these laptop and notebook computers can be a little tricky, though. You must either use the supplied rechargeable batteries, or carefully supply regulated current to the machine from your main battery supply. If you do use your main supply, make sure you know what the computer expects.

The Radio

The handheld is the obvious choice for portable packet. Modern handhelds are frequency agile, very power efficient when receiving, and readily available—but there is no reason that you cannot use a mobile radio if your station is to operate from either a vehicle or in a fixed position. Whichever radio you choose, make sure that it is a reliable one. While you might save some money buying an older radio, you might also end up without a working station when you really need it. Be sure, also, to consider scaling your battery supply to its current requirements. For mobile rigs, consider a separate battery.

The Cables

The cables that interconnect the components of your station—power, data, audio, etc.—should be of the highest quality. Carefully choose well-made connectors and cable and carefully build *two* sets. This way, if one fails you will have a backup. Be sure to make the cables long enough to cover all the possibilities—better too long than too short.

A Carrying Case

You will need some sort of container for your equipment. It should be easily packed and unpacked, weatherproof, and protect the equipment inside from the bumps and bangs that it is likely to receive while being moved around. This case can range from a fancy aluminum briefcase to a plastic tub with foam inserts. The key is protecting and transporting the equipment inside.

Miscellaneous Equipment

A portable packet station, like any portable radio station, requires other equipment to be useful in an emergency. Don't forget that at night you will need some sort of lighting. Look at the lighting equipment available for recreational vehicles—this stuff runs from 12V and there is quite a variety. I found an old "high intensity" desk lamp and bypassed the transformer inside, connecting the 12V directly to the lamp. If you do this, leave the transformer in place for weight.

The other equipment is somewhat "low-tech"—pens and paper. Make sure you have lots of stuff to write with—you will need it. Also consider carrying a first aid kit and some food.

A portable or mobile packet station can be fun to build and operate, and in an emergency it can help your local disaster relief organization get information in and out of an affected area. Please let me know if you build a station, or if you have already built one, and what you use for the various parts. If you have some tips you can share, I'll be glad to pass them on. 73 de N1EWO.

Number 20 on your Feedback card

HAMS WITH CLASS

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The CQ All Schools Net From The Pentagon

Over the last live years my students and I have had unqualified lun meeting new and interesting people on the CQ All Schools net. Part ol the lun is that you really never know who is going to pop up at the other end of that contact. We've enjoyed contacts with thousands of ham radio operators from every walk of life . . . engineers, architects, teachers, students, doctors, pilots, clowns, herpetologists, dentists, and astronauts. Of course, every contact provides the classroom teacher with the ability to explore in greater detail the enrichment that these different backgrounds can provide educationally to the children.

Gordon West WB6NOA and I were especially delighted one day when we heard K4AF, the Pentagon Amateur Radio Station, check in to our net. Pat WJOT and Mike KD4IIZ proceeded to tell the school children who were standing by on frequency all about the Pentagon. The first fact that surprised all the children was that this unusual building is located in Arlington, Virginia, not in Washington, D.C.

I immediately seized the opportunity to launch an "extra credit" project on the Pentagon. By the time Pat and Mike tried to contact us on the net again, we had accumulated a roomful of reports, dioramas and pictures of the Pentagon. Since our net meets on 28.303 MHz, we often had a hard time hearing K4AF really well. However, other schools across the country who were checked in on the net told me how much they were enjoying the contacts.

It was amazing to learn all the myths there are about the Pentagon. I must admit that even I had a new appreciation of the size of the building after listening to some of the children's reports. The Pentagon, headquarters of the Department of Defense, is one of the world's largest office buildings. It is twice the size ol the Merchandise Mart in Chicago, and has three limes the floor space as the Empire State Building in New York. The national Capitol could lit into any one of its five wedge-shaped sections.

My 6th, 7th and 8th graders and I were enjoying our research about the government and the Department of Delense when Pat extended an invitation to visit the Pentagon in person. Needless to say, we were incredibly excited about this new adventure. Pat and I agreed that it would be a terrific experience for me to conduct the CQ All Schools net from the ham shack at the Pentagon while I was there. It's wonderful to see how the students rally to become involved in exciting projects like this. It was the idea of my ham radio students to invite a ham friend ol mine to be present with the youngsters at the ham shack in our room at Intermediate School 72 in Staten Island, New York, so that they could contact me on the net.

My good friend John Anzivino WA2QYX, who is terrific with children, agreed to help us out by manning the station at our school. John has been to our school many times to demonstrate ATV with fellow BEMARC club members. When the big day came on June 11th, my principal, Barbara Glassman, was extremely impressed with the way that John handled the packed classroom of children. He conducted mini-lessons about the Pentagon and about radio propagation, explaining the problem of a 10 meter contact between New York and Virginia. He made a wonderful instructor and I will always be grateful for his support.

At the Pentagon

My visit to the Pentagon was incredible. I loved it! It was informative and totally enjoyable, thanks to the hospitality of Pat's wife, Mary, and the members of the Amateur Radio Club there. I learned that the Pentagon is really a city unto itself. About 23,000 employees, both military and civilian, work there. They ride past 200 acres of lawn to park about 10,000 cars in four parking lots; climb 150 stairways or ride 19 escalators to reach offices that occupy 3,705,793 square feet. While in the building, they can walk down 17-1/2 miles of corridors, tell time by 4,200 clocks, utilize 280 rest rooms, consume 30,000 cups of coffee, 6,000 pints of milk, and 5,000 soft drinks daily.

Over 200,000 telephone calls are made daily through phones connected by 100,000 miles of telephone cable. The Defense Post Office handles about 130,000 pieces of mail daily. Various libraries support the personnel in research and completion of their work. The Army Library alone provides 300,000 publications and 1,700 periodicals in various languages.

The Department ol Defense is managed by a civilian Secretary of Defense appointed by the president of the United States. The highest ranking military position is that of the Chairman, Joint Chief of Staff. While not a member of the Department of Defense, the Coast Guard is at all times one of the five Armed Forces of the United States.

Following an exciting tour of some of the highlights ol this most unusual building, Pat escorted me up to the fifth floor where the K4AF station is. Mike KD4II and Major Dick Lum NH6E were there to greet me. Both Mike and Pat worked diligenlly with me to log in the schools and ham operators who were standing by for the net. I had arranged with John, back at my school in Staten Island, to switch from 10 meters to 20 meters il we couldn't hook up in 10 minutes. Unfortunately, I was never able to hear the kids at my school, but they were able to hear me calling them and speaking to other school children.

Jim Wilmerding N4MDC is our net control in New Orleans, Louisiana. He did a super job on June 11th relaying messages for us. So often, I find myself thinking how nothing really worthwhile ever happens in ham radio with just one person. Over and over again, I am impressed by the way hams rally to help each other for the greater good of a project or a cause. The net ran for 90 minutes that day, with scarcely a pause between check-ins. We spoke to a high school in Toronto, a ham in Bermuda, a snake collector in Florida, a French high school student in Ottawa, and an engineer at CBS TV in Los Angeles.

In true ham tradition, Nancy Bucher N6XQR had arranged for a radio to be set up in the classroom of the sister of the Chairman of the Joint Chiefs of Staff, General Colin Powell. With the help of local hams in Santa Ana, California, like David Corsiglia WA6TWF and Mary Williams AB6CZ, Nancy was responsible for the terrific contact between Mrs. Berns' 5th grade class and me while I was running the net from the Pentagon that day. With the help of lots of dedicated hams, we plan to have follow-up exchanges between our schools.

I thoroughly enjoyed conducting the CQ All Schools net that day from a very special location. I'd especially like to thank Mike Cash for being such an able assistant with the log book, and Pat Oliver for all his efforts in arranging my visit. When I arrived back in school the next day, I was greeted by a group of eager and highly motivated children who couldn't wait to tell me what happened in my room as they were listening to the net, and to find out about all the things I had experienced at the Pentagon. It's so uplifting when kids get all excited about good things.

The Pentagon Amateur Radio Club has 56 active members with 40 percent of them being Extra class. They have a full packet radio station along with HF and UHF capabilities. The Air Force Morale Support Organization set up and maintains the very well equipped station.

Whenever I go on an interesting field trip such as this, I'm always on the lookout for material to bring back to other teachers at my school. This time I brought back some literature written about the Pentagon for the social studies teachers, the same literature translated into French, Spanish, German and Japanese for the foreign language and ESL (English as a second language) teachers, and structural information and statistics about the building itself for the science department. It really wound up becoming a school-wide project, which is great because it generates the children's interests in many different areas, and brings some worldliness and relevance into their school curricula.

Please join us this fall for the CQ All Schools net on Tuesdays and Thursdays at 16:30 UTC on 28.303 MHz and share the fun of introducing youngsters to all that is exciting about amateur radio.

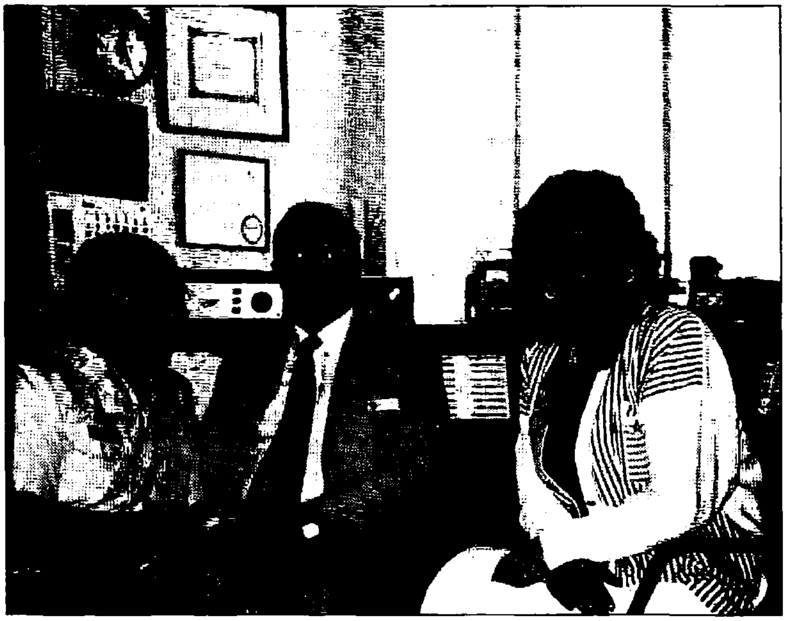

Photo A. Left to right: Pat WJOT, Mike KD4IIZ and Carole WB2MGP at the Pentagon ARS.

QRP

Number 21 on your Feedback card

Low Power Operation

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Why Use a Bidirectional Power Meter?

A bidirectional power meter will instantly tell the user how much RF power is going out to the antenna and how much power is being reflected back to the transmitter. A bidirectional power meter is NOT an SWR indicator in itself.

However, by using a monograph, you'll be able to get the exact standing wave ratio. But you really don't need the monograph either, as experience and common sense will give you a really good idea of what the standing wave ratio is by simply monitoring the two meters. Did I say two meters? Yes, a bidirectional power meter usually has two meters: both reading RF at the same time, but from both (forward and reflected) directions. One meter could be switch-selected, but somehow this takes away some of the advantages of watching both meters.

With two meters, as the SWR increases the reflected power meter will show an increase in deflection. Likewise, as the transmitter is matched to the antenna, the reflected power reading will go down. Ideally, it should read zero watts reflected, with an SWR of 1:1.

With a bidirectional power meter, you don't have to adjust a calibration control or select a power scale (within the design of the meter) to get a reading.

If all of this sounds too good to be true, there must be a catch somewhere.

Well, there can be a trade off when it comes to frequency spread if the design is deficient. This is of course true in just about any RF power meter circuit. But a directional RF bridge can be a real challenge. Besides that, you have to come up with two matching meters. I've always been surprised that the prices of analog meters have not fallen due to the number of digital readout and displays you see used today. Instead, analog meters have soared out of price. And, of course, everyone yells and screams about getting all the parts together anyway.

Building a Bidirectional Wattmeter

Thanks to Kanga Products of England, you can have your own bidirectional RF power meter for less than $50, or maybe even less than that depending on how much junk your (or some one else's) junk box has in stock. Oh yes, not to worry about British pounds and U.S. dollars; Kanga Products has a U.S. sales agent here in the states.

The kit as it comes from Kanga is very basic. There is no PC board. You get a bag of parts and several sheets of instructions. The instructions for the project are very meager. Although it is definitely not a hard kit to build, it's not a Heathkit by a long shot. The Kanga kit is not for the novice builder. If you're looking for (or need) step-by-step instructions, you won't find them here. If the bidirectional RF power meter is a bit more than you can chew, then you can return it *as supplied* for a full refund.

The meters (and you'll need two) are NOT included. You can purchase them for $5 each and, unless you have some in the junk box, it would be a good idea to get the meters with the kit.

Although the meters specified for use with the kit are for 50 micro amp meters, the ones supplied to me with my kit are in fact 100 microamp meters. They work just fine, with perhaps just a slight trade off in low-low power readings. I can measure down to 1 watt and still have full-scale deflection with the 100 micro amp meters. The meter face reads 0 to 20 watts, as they come. The meter's scale will need to be changed, or you can calibrate the RF meter to use the scale as is. It's up to you and, either way, it won't effect the operation of the bidirectional RF meter. I choose to use the meter(s) face as is.

A full-size drawing of the bidirectional RF power meter is included. I used this drawing only to construct the circuit. The schematic is clear, yet at the same time a bit discomforting. The pictorial made more sense to me during construction than did the schematic. I must be getting older or something.

Looking at the schematic, the bidirectional wattmeter is really nothing more that two transformers. If you feed RF into connector RAS, power passes through the transformers. Just about 99 percent of the power goes to the other connector, RBS, and to your antenna. The one percent comes out of connector RDS and into its 50-ohm resistor termination.

If your antenna does not present a perfect 50-ohm impedance, some power will be reflected and will pass backwards through the hybrid from RBS to RAS, with 99 percent of this reflected power reaching RAS. The remaining one percent is diverted to connector RCS and dissipated in its 50-ohm resistor. In both cases, the resulting RF is then rectified and displayed on the two meters. One will read REFLECTED power and the other FORWARD power, both at the same time.

Dick Pascoe GØBPS, operator of Kanga products, informs me the coupling factor is about -21 dB with 12 turns of wire on the secondary of the transformers. The meter was measured at -21.59 +/-0.01 dB over 1.5 to 50 MHz. This flatness is excellent and is due mainly to the core material used in the transformers. No, I don't know what type or kind they are. They're supplied in the kit.

Plots of through-path attenuation are less than 0.1 dB over 1.5 to 50 MHz. The forward termination dissipates 0.69 percent of the forward power. The bidirectional RF meter may be used with the transmitter up to 150 watts output.

With only a handful of parts, construction goes very quickly after you have both transformers wound and the stand-offs in place. A large soldering iron or soldering gun will prove very handy when soldering to the SO-239s.

You'll need to drill two large holes to mount the SO-239s to the box. There are also several insulated stand-offs that you'll be required to mount. I found my battery powered drill priceless in drilling these holes. Of course, a drill press would be fine, but you're cramped inside the box. I had to hold the transformer with one hand to find the exact place to put the stand-off with the other hand. The small drill worked beautifully. The die-cast aluminum box holding the electronics cuts and drills very easily. If you want to try and duplicate this circuit (without buying the kit), you must enclose the transformers in some type of metal box. You must shield these transformers; If you don't the stray RF will cause errors. Double-sided PC board material would be an excellent choice to house the transformers. As for the cores, I'd try my luck with a T-60-6 core.

I built my meter in a small case I picked up at Dayton several years ago. This clamshell case is easy to work with and provides a great deal of extra RF shielding, both to the RF pickup transformers and the two meters. I left the back of the case open to allow easy hook-up for the "in" and "out" SO-239s. If you wanted to, you could remote the pick-up sensors and run a multiwire cable back to the meters. I have not tried this. It should work without trouble. I would not run the cable more than three or four feet at most.

Calibration

You'll need a transmitter and a 50-ohm dummy load to calibrate your bidirectional meter. Calibration Is easy. You change one resistor for each meter. A 22k resistor will result in a 5-watt full-scale deflection. Using a 56k resistor will provide for a 20-watt full-scale reading. This will provide better than 10 percent accuracy. You can also use a fixed resistor and trimmer for greater accuracy, but you'll need laboratory equipment to set up everything.

All you have to do is apply RF with the external RF wattmeter in line, then verify that the bidirectional wattmeter reads the same forward power. Reverse the two coaxes and check the reflected meter's scale. It's that easy and it's done.

I'm all and all very happy with the bidirectional wattmeter from Kanga products. I've been surprised by how well it covers different frequencies without introducing errors in the readings. I've used it up to 144 MHz with great results. On frequencies up to 432, I've noticed about 1.8 SWR insertion with the meter. It still works and it's a great way to tell the SWR on the antenna, and if there is anything coming out of the 432 transmitter! Not bad for a handful of parts!

You can purchase the Kanga kit from Bill Kelsey N8ET, 3521 Spring Lake Drive, Findlay OH 45840. The price is $35 for the kit plus $3.50 for shipping. Ohio orders please add 5.5 percent state tax. Bill takes MC/Visa or check/money orders. Bill also carries other Kanga products. If you want a catalog, you MUST include an SASE.

Next month, as winter gets a grip on the Ohio countryside, I'll take a second look at the Ten-Tec Argonaut II deluxe QRP transceiver. Ten-Tec listened to our requests and fixed some bugs crawling around in the Argo II. Watch next month for a re-visit with the Argo II.

Photo A. The Kanga Products' bidirectional RF power meter.

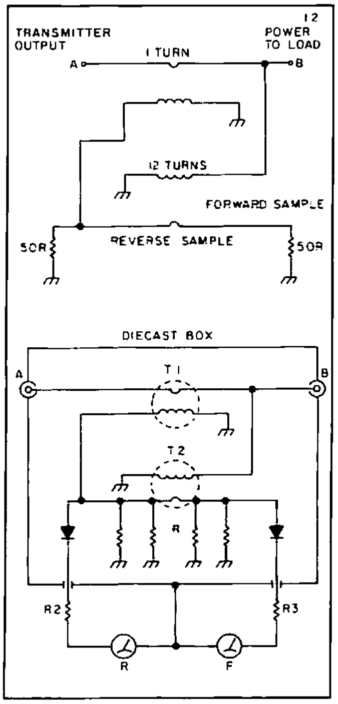


Figure 1(a). Schematic diagram of the Kanga Products bidirectional power meter. (b). Pictorial layout of the power meter.

Number 22 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events in Area #11** on our **BBS (603- 924-9343)**. for listings that were too late to get into publication.*

OCT 3-4

BOXBORO, MA The 1992 New England ARRL Convention will be held at the Host Inn and Conference Center (formerly Sheraton), from 9 AM-5 PM Sat.; 10 AM-2 PM Sun. This Convention is being presented by ***The Federation of Eastern Massachusetts Amateur Radio Associations. Tel. (617) 631-7388.***

OCT 4

HUNTINGTON, IN The Huntington County ARS will sponsor its 4th annual Hamfest at the PAL (Police Athletic League) Club from 8 AM-3 PM. Set-up at 6 AM. Indoor Flea Market. Free Parking. VE Exams. Handicap accessible. Advance tickets $3.50, $4 at the door. 8' tables are $5 on a first-come first-served basis. Talk-in on 146.085/.685 and 448.975/443.975. For tickets and tables contact ***Ray Tackett KC9DZ, 420 Market St., Andrews IN 46702.***

OCT 9-10

AUGUSTA, GA The ARC of Augusta will sponsor a Hamfest at the Civic Center, 601 7th St., downtown, exit 46 on I-20 from 6 PM-9 PM Fri., and from 8 AM-5 PM Sat. Set-up 3 PM Fri., 6 AM Sat. Free parking. Handicap accessible. RV Parking. VE Exams: registration at 12 noon, testing at 1 PM; bring 2 forms of ID, Novice exam is free; upgrades bring original license, copy, and $5.40. Flea Market. Admission $4 in advance, $5 at the door. Children 12 and under free. Tables $10. Talk-in on 144.89/145.49. For tickets/tables, send SASE and check to ***Paul Murray N4XTD, Burden Lake Rd., Aiken SC 29803.***

OCT 10

BALDWINSVILLE, NY The Radio Amateurs of Greater Syracuse (RAGS) will hold its 37th Hamfest at the Tricounty Convention Center from 9 AM-4 PM. Flea Market set-up is 4-10 PM Fri., and 6:30-8:30 AM Sat. All indoors. Wheelchair accessible. Pre-register for VE Exams. There will be commercial vendors, computers, tech talks, contests. Restaurants, movie theaters and snack bars are all on the premises. Talk-in on 146.31/.91 MHz. For inquiries call ***(315) 469-0590.***

GRAND FORKS, ND The Forx ARC will hold their Hamfest in the Grand Forks Civic Auditorium, 615 1st Ave. North. Swapfest with tables provided. VE Exams. Forums. Admission $4. Talk-in on 146.34/.94. Contact ***Gerry Nies NØNGW, 1815 University Ave., Grand Forks ND 58203. Tel. (701) 775-5066.***

HUNTINGTON, WV W5YI testing sessions, sponsored by the Tri-State ARA, Inc. VE Team, will be held at Our Lady of Fatima church school class rooms, 545 Norway Ave., at 10 AM. Bring a photo ID, a copy of current licenses or original CSCE, and a completed Form 610. Form 610 will be available at the test session. No pre-regislration necessary. Arrive by 9:15 AM to register, and to have ID and Form 610 checked prior to examination. For info call ***Jim Baker K8KVX, (304) 736-6542.***

KITSAP, WA The North Kitsap ARC will present their 1st annual Hamfest/Swapmeet, at the Kitsap County Fairgrounds, President's Hall (northwest corner of Fairgrounds and Nels Nelson Rds.) from 9 AM-4 PM. Admission $4 at the door. To reserve tables, contact ***Matt Amis AA7LP, 2196 California Ave. E., Port Orchard WA 98366. Tel.(206) 871-7099.***

TEANECK, NJ The Bergen ARA will hold its annual Fall Hamfest from 8 AM-2 PM at Fairleigh Dickinson University. From the east, follow Rte. 4 west to River Rd. exit. From the west, follow Rte. 4 west to River Rd. exit. Admission $2. XYL and harmonics free. Sellers $10 per parking space. Space with power $20 (pre-registration required). For Hamfest info,—contact ***Jim Joyce K2ZO, (201) 664-6725.*** Talk-in on 146.190/.790 and 145.620 simplex. For VE Exams info, call ***Pete Adely K2MHP, (201) 796-6622.*** Please, no calls after 10 PM.

OCT 10-11

EL PASO, TX The International Hamfiesta will be held at the Texas National Guard Bldg., 9100 Gateway Blvd. North, on Sat. from 8 AM-5 PM, and Sun. 8 AM-3 PM. RV parking, no hookups. Admission $5 in advance, $6 at the door. Tables $5. Tailgate spaces $5. Seminars, QCWA Breakfast. VE Exams both days. Talk-in on 146.88 rptr. Contact ***Clay Emert K5TRW, Box 31628, El Paso TX 79931. Tel. (915) 859-5502.***

MEMPHIS, TN The Greater Memphis Amateur Radio and Computer Show, MemFest 92, sponsored by the Mid-South ARA, will be held at the Mid-South Fairgrounds in the Pipkin Bldg., Sat. 9 AM-4 PM, and Sun. 9 AM-2 PM. Admission $5 at the door. VE Exams Sat. and Sun. 9 AM-12 noon. Flea Market tables $20 per table for the weekend; contact ***Steve Cheeseman NX3W, 3290 New Getwell, Memphis TN 38118. Tel. (901) 365-6621 (W), (901) 368-6781 (H).*** Exhibitors contact ***Nita Woofford N4DON, 2966 Cordell, Memphis TN 38118. Tel. (901) 363-4971.*** Talk-in on 146.28/.88 and 449.00/444.00.

OCT 11

WAUKESHA, WI The Kettle Moraine RAC Inc. will hold its 14th annual Ham/Computer Swapfest at the Waukesha County Exposition Center, Hwys J & FT. All indoors from 8 AM-1 PM. Advance tickets $4, $5 at the door. Reserved tables are $5 for each 4' length (admission ticket required). Reservation deadline Is Oct. 3rd. Vendor set-up at 6 AM. The Badger Exminers will conduct Exams. For reservations, send a check payable to ***KMRA Swapfest, P.O. Box 411, Waukesha WI 53187-0411.*** Please include an SASE. Waukesha County Airport is next door for fly-ins.

OCT 17

GRAY, TN The Appalachian Fair Grounds, off I-181, will be the location for the 12th annual Tri-Cities Hamfest, sponsored by the Kingsport, Bristol, and Johnson City Radio Clubs. Drive-in indoor and outdoor Flea Market space is available. RV hookups. Admission $5. Mail inquiries to ***Tri-Cities Hamfest, P.O. Box 3682 CRS, Johnson City TN 37602.***

SCOTCH PLAINS, NJ The Tri-County Radio Assn. will hold their TCRA Hamputer Fest, from 8 AM-2 PM, at the Union Catholic Regional High School (on Martine Rd.). Donation $4. Children under 12 admitted free (must be accompanied by a parent). For walk-in VE Exams, please arrive by 9:30 AM. Bring check for $5.40 made out to "ARRL VEC" for all except Novice exams. Also bring your original license and a Xerox copy; 2 forms of ID; pencils and a pen. Reservations required for: Tailgating $8; Tables $10 ($12 with power). Contact ***Dick Franklin W2EUF, 310 Indian Trail, Mountainside NJ 07092. Tel. (908) 654-4943.***

OCT 18

CAMBRIDGE, MA A Tailgate electronics, computer and amateur radio Flea Market will be held at Albany and Main Streets from 9 AM-2 PM by the MIT Electronics Research Society, the MIT Radio Society, and the Harvard Wireless Club. Free off-street parking. Tailgating. Admission $2. Sellers, $8 per space at the gate, $5 in advance (includes one admission). Set-up at 7 AM. For space reservations/info, call ***(617) 253-3776.*** Mail advance reservations before Oct. 5th to ***W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/ 444.725—pl 2A—W1XM rptr.

CENTRALIA, IL The Centralia Wireless Assn., Inc., will hold its annual Hamfest at the Kaskaskia College Gymnasium, 3 miles Northwest of Centralia IL, starting at 8 AM. Set-up is at 6 AM. Free parking. Reserve your tables in advance @ $1/foot. Bring your own tables @ $.50 per foot. Tailgating free. Admission/Main Prize tickets are $2 each or 3/$5, purchased in advance or at the Hamfest. For table and space reservations, contact ***Bud King WA9U, (618) 532-6606.*** Mail ticket orders with an SASE to ***Centralia Wireless Assn., Inc., Hamfest Tickets, P.O. Box 1166, Centralia IL 62801.***

KALAMAZOO, MI The Southwest MI AR Team and the Kalamazoo ARC will co-sponsor a Hamfest at Kalamazoo Central High School. Take US 131 to M-43 east to Drake Rd., then north to the school. Doors open at 8 AM. Set-up at 6 AM. Advance tickets $2, $3 at the door. Free parking. No testing. Tables are $1.50/ft, 4 ft min. Send requests and payment with SASE before Oct. 7 to ***Gary Hazelton KB8PL, 75075 M-40, Lawton MI 49065.*** Make checks payable to ***Kalamazoo Hamfest.***

MARION, OH The Marion ARC will present its 18th annual Heart of Ohio Hamfiesta/Computer Show at the Marion County Fairgrounds Coliseum from 8 AM-3 PM. Free parking. Advance tickets $4; $5 at the door. Tables $8. Talk-in on 147.90/.30 rptr. Contact ***Dan Burns N8JMF, 844 Robinson, Marion OH 43302. Tel. (614) 382-2384*** M-F after 4 PM, or S-S all day.

MILAN, OH The 1992 FARA Hamfest/ Computer Fair will be sponsored by the Firelands ARA, indoors at the EHOVE Vocational School, just 1/4 mile north from Ohio turnpike Exit 7 (I-80/90) Rt. 250. Mobile Check-in is on 146.805/.205 MHz. Advance tickets $3, $4 at the gate. 8' tables $8 ea. Set-up Sat. 7 PM-10 PM; Sun. 6 AM. Gates open at 8 AM. Packet seminar/demonstration. ARRL Awards rep will be on hand to certify hams for DXCC. Ohio's largest factory outlet mall is across the street. A discount coupon book is provided for all ticket holders. Contact ***Gene Hutchins, 45 Welton Ave., Norwalk OH 44857. Tel. (419) 668-5796.***

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01 111th St. Vendor set-up at 7:30 AM. Buyers admitted at 9 AM. Free parking. Admission: Buyers $5, Sellers $8 per space. Talk-in on 445.175 NB2A rptr., 146.52 simplex. Call at night, ***Charles Becker WA2JUJ, (516) 694-3955; Arnie Schiffman WB2YXB, (718) 343-0172.***

TUCSON, AZ De Anza Drive-In, 22nd St. and Alvernon Way, will be the site of the 5th annual Tucson Hamfest, sponsored by the Old Pueblo Radio Club, ARRL and ARCA. Open from 7 AM-1 PM. There will be meetings for ARCA, Repeater Owners, and AZ Node Operators. Flea Market. Sellers $4 per space (includes FREE cup of coffee and FREE drawing ticket). Buyers $1. Talk-in on 146.22/.82, 146.28/.88, and 146.52 simplex. Contact ***A.J. Pawlowski KB7K2, 3418 W. Green Trees Dr., Tucson AZ 85741. Tel. (602) 742-2605.***

OCT 24

GRANDVIEW, MO The annual Octoberfest, sponsored by the Southside ARC, will be held at Grandview East Junior High School, 12650 Manchester, from 8 AM-3 PM. Free parking. Wheelchair accessible. Advance tickets 4/$5; 3/$5 or $3 each at the door. Table space $12 per table, limit 3 per exhibitor. Set-up at 6:30 AM. Talk-in on 147.12+. A transmitter hunt will follow the hamfest. Contact ***Southside ARC, P.O. Box 1142, Grandview MO 64030,*** or ***Frank Staudenraus NØGXO, (816) 331-7338.***

GREENWOOD, N.S., CANADA The Greenwood ARC will hold its 4th annual Ham/Electronics Flea Market from 9 AM-2 PM at the Greenwood Community Center in Greenwood, Nova Scotia. Talk-in on 147.240+ VE1WN rptr. Contact ***Jim Baskey VE1APV, Greenwood ARC, P.O. Box 63, Greenwood NS BOP 1N0, Canada. Tel. (902) 765-6272,*** or ***FAX (902) 765-5449.***

SUMTER, SC The Sumter ARC will hold their 6th annual Hamfest at the Sumter Exhibition Center, 700 W. Liberty St., from 8 AM-4 PM. VE Exams. CW Contest. Friday night Cookout. Admission $5. Tables $6. Talk-in on 147.015. Contact ***Dan Mask WB5SGH, (803) 775-9106,*** or write to ***P.O. Box 193, Sumter SC 29151.***

OCT 24-25

CHATTANOOGA, TN Hamfest Chattanooga will hold their Amateur Radio & Computer Convention at the Chattanooga-Hamilton County Convention & Trade Center. For more info, contact ***Barbarra Gregory WA4RMC, P.O. Box 3377, Chattanooga TN 37404. Tel. (615) 892-8889.***

OCT 25

DUBLIN, PA The R.F. Hill ARC will hold their annual Hamfest at the Dublin Firehouse, Rte 313, 5 miles from Doylestown. VE Exams, all classes; bring documents. Flea Market spaces: indoors $8; outdoors $6. Bring your own tables. Admission $5. Hamfest Hotline: ***Bob Frantz, (215) 536-9098*** or ***P.O. Box 29, Colmar PA 18915.***

MILFORD, CT The Coastline Amateur ARA will conduct VE Exams for all classes at the Fowler Bldg., 145 Bridgeport Ave., starting at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125*** or ***Dick WA1YQE, (203) 874-1014.***

OCT 31

FRANKLIN, KY FranklinFest '92 will be sponsored by the Southern Kentucky AR Group, on Wall St., from 8 AM-2 PM. Directions: from the North—exit 6 off of I-65, Weston KY 100, turn left onto KY 1008 to Wall St. Event is on the right side of the intersection. From the South—Exit 2 off of I-65, north on US 31W, right on 1008, left on Wall St., we're on the right. Nashville is only 40 minutes away. Admission $5 in advance. Tables $4. Free parking for cars, RVs and busses. Talk-in on 146.065/.665 and 146.52. Contact ***Ed Schwab KA4REF, P.O. Box 9656, Bowling Green KY 42102. Tel. (502) 843-4389.***

GROTON, CT The annual Tri-City ARC Auction will be held at the Senior Citizens Center, Waterford Municipal Complex (Rt. 85, south of Exit 77 of I-395, or north of Exit 82 of I-95). Set-up at 9 AM. Auction from 10 AM until sold out. Free admission. Wheel chair access. Bring your equipment to be auctioned. Talk-in on 146.07/.67 rptr. For info call ***KA1BB, (203) 739-8016.***

ST. LOUIS, MO The Gateway Ham Radio Club will sponsor a Hamfest at the West County Technical School from 8:30 AM-2 PM. Set-up at 6:30 AM. Exit south from I64/US40 on Maryville Center Drive. VE Exams: call ***(314) 567-8777*** to register. Flea Market. Admission tickets $1 in advance, $2 at the door. Indoor tables $5. Tailgating $3. Talk-in on 146.94/4. Contact ***Angie Fischer KBØHXY, (314) 225-5560,*** or ***Dave Novak NØDN, 10 Ann Ave., Valley Park MO 63088. Tel. (314) 225-1952,*** answering machine.

ST. PAUL, MN The 8th annual Hamfest Minnesota & Computer Expo will be held at the St. Paul Civic Center. Presented by the Twin Cities FM Club, "The Big One" will feature major manufacturers, a huge indoor Flea Market, VE Exams, etc. Advance tickets $5, $6 at the door. Tables $18 ea. Special educational seminar by Carole Perry WB2MPG. Talk-in on 146.16/.76 rptr. For info, write ***Hamfest Minnesota & Computer Expo!, P.O. Box 5598, Hopkins MN 55343,*** or call the ***Minnesota Hotline, (612) 535-0637.***

NOV 8

LONG ISLAND, NY HAMEXPO, sponsored by the Radio Central ARC, will be held from 9 AM-4PM at Suffolk Community College, Long Island Expwy exit 62—Nicholls Rd./County Rd. 97 North 1 mile. Free parking. All indoor Flea Market, ham dealers, computer show, VE Exams, DX. Admission $5 at the door. Tables $20 in advance. Send to ***Radio Central ARC, P.O. Box 680, Miller Place NY 11764.*** Talk-in on 145.15-4Z or 449.525-2A. Contact ***John Mark KB2QQ, (516) 689-6336*** or ***Jo Ann Colletti N2IME, (516) 399-1877.***

SPECIAL EVENT STATIONS

OCTOBER 1992

BAHAMAS The Bahamas ARS will operate C6A500 throughout the month of October, to commemorate the 500th anniversary of the discovery of the New World by Christopher Columbus. Operation will be continuous during 0001Z-2359Z Oct. 12, otherwise, intermittent coverage will be kept through the month. Frequencies: 3590, 3740, 7030, 7090, 7290, 14,070, 14,135, 14,290, 18,150, 21,140, 21,204, 21,390, 24,950, 28,190, 28,350, 28,990, 146.640 -600. All authorized BARS members may operate in Oct. with /500 suffix. Awards: 1. Three different /500 contacts; 2. Ten different /500 contacts (one must be C6A500). For QSL send SAE and 3 IRCs to ***BARS, Box SS.6004, Nassau, Bahamas, or Bahamas Bureau.*** For an award, send a copy of your log with 3 IRCs.

OCT 1

HOUSTON, TX The M.D. Anderson Hospital AR Volunteers, sponsored by the University of Texas M.D. Anderson Cancer Center, will operate Station KK5W, 1500Z-2100Z, to commemorate the 9th annual Childrens' Christmas Card Parade through the Medical Center. During 1630Z-1830Z, operation will be from a float in the parade. Frequencies: 7,292.9, 18,129.9, 21,392.9, 28,392.9. For a certificate, send QSL and a 9 x 12 SASE to ***KK5W, M.D. Anderson Hospital, Amateur Radio Volunteers, 1515 Holcombe Blvd., Houston TX 77030-4095.***

OCT 3-4

PITTSBURGH, PA The Breezeshooters ARC will operate W3XX from the USS Requin SS481, a WWII submarine. Time: 1400Z-2100Z each day. Phone frequencies: 28.450, 21.350, 14.250, 7.250, 146.52. CW frequencies: 28.150, 21.050, 14.050, 7.050. This SE Station is being operated to celebrate the 1st year anniversary of the Carnegie Science Center. For a QSL card and certificate, send an 8 1/2 x 11 SASE to ***Ron Berry WB3LHD, 326 Sunset Dr., Bethel Park PA 15102.***

OCT 10-11

COLOMBUS, IL The Western Illinois ARC will operate Station W9AWE in celebration of the Quincentennary of the European Discovery of America. Time: 1400Z Oct. 10-2400Z Oct. 11. General SSB and CW sub-bands, packet, and 147.03 W9AWE rptr. For certificate, send QSL and SASE to ***WIARC, P.O. Box 3132, Quincy IL 62305.***

NEWCASTLE, IN The Henry County ARC will operate Station KA9RWP in conjunction with the "Raintree Jamboree," beginning at 10 AM both days, on the General portion of 80m, 40m, 20m, and 21.385/28.385. Contact ***KA9RWP, P.O. Box 607, New Castle IN 47362.***

TULSA, OK Tulsa ARC, under the call sign W5OK, will be the official SE Station for the "Year of the Indian 1992" being celebrated throughout the State of Oklahoma. The Office of State Tourism has recognized the TARC for this celebration. The event will begin at 1700Z Oct. 10 and will end 1700Z Oct. 11. Phone—lower 25 kHz of the General 15, 20, 40, and 80 meter sub-bands and the Novice 10 meter sub-band. There will also be a 2 meter SSB station. CW—lower 25 kHz or the General 20, 40 and 80 meter sub-bands and the Novice 15 meter sub-band. For a unique certificate, send QSL and a 9 x 12 SASE to ***Tulsa Amateur Radio club, P.O. Box 4283, Tulsa OK 74159.***

OCT 11-12

COLUMBUS, OH The Columbus ARA will operate W8TO 11 AM-10 PM EST (1600-0300Z) Sat., and 11 AM-8 PM EST (1600-0100Z) Sun., to commemorate Columbus Day and the 500th anniversary of the discovery of the Americas. The station will operate portable from the Columbus Day Celebration Site, Riverfront Dr., downtown Columbus, in the General and Advanced portions of 10, 15, 20, 40, and 80 meters, beginning with the 10m band and moving to the next band every two hours each day. Contact with W8TO counts 6 points per band per day. Contacts with any other central Ohio station (0500Z Fri.-0500Z Sun.) on any HF band counts 1 point per station per day. For a commemorative certificate, send a copy of the log sheet(s) which show contacts worth at least 10 points, and a 9 x 12 SASE, to ***Thomas Camm, 1634 Dundee Ct., Columbus OH 43227-2421.***

OCT 15-18

CINCINNATI, OH U.S.A. area radio amateurs will participate in the 1992 Tall Stacks Celebration of America's river steamboating era, throughout the month of Oct. On-air operation is sponsored by the Greater Cincinnati ARA and the OH-KY-IN ARS. QSL cards will feature the 17 historic steam paddle riverboats that will assemble on the Ohio River at the Port of Cincinnati from 15-18 Oct. QSLs will be available from Tall Stacks stations, for contacts throughout Oct. Participating stations will use the call sign suffixes "Tall Stacks" or "/TS." OH-KY-IN station K8SCH will be particularly active Oct. 15-18. Tall Stacks, sponsored by the Greater Cincinnati Convention and Visitors Bureau, recalls the historic and continuing importance of river commerce to middle America.

OCT 16-17

GILMER, TX East Texas area amateurs will operate KI5UA to celebrate the 55th annual East Texas Yamboree. Operation will be in the General 40, 20 and 15 meter phone sub-bands; the Novice 10 meter phone sub-band, and locally on the 147.32 rptr. For a certificate, send your QSL and 8 x 12 SASE to ***KI5UA, Rt. 2, Box 113, Diana TX 75640.***

OCT 20-21

WESTMONT, IL The Westmont ARC will sponsor a School-to-School QSO Party from 0800Z Oct. 20-0800Z Oct. 21. This event allows students of all cultures to meet one another via Ham Radio. If you want to participate, please drop a packet via ***S-KA9GQF @ W9QVE No. II. "School to School."*** Send all reports to ***Westmont ARC, P.O. Box 8, Westmont IL 60559, USA.***

OCT 21-23

NEW YORK, NY The "22 Crew" will operate WB2JKJ from the headquarters of the Radio club of Junior High School 22 to celebrate the 12th anniversary of the Club, and EDUCOM, Education thru Communication. Join them on 7.238 MHz from 1200-1330 UTC, then on to 21.395 till 2000 UTC. For an outrageous QSL and surprise package, write to ***RC of JHS 22, P.O. Box 1052, New York NY 10002,*** or FAX it to ***(516) 674-9600.***

OCT 23-25

UNION, KY The Northern Kentucky ARC will operate K4CO 1400-2100Z from Big Bone Lick State Park, in conjunction with the annual Salt Festival and The Commonwealth of Kentucky's Bicentennial Celebration. Operation will be on 40, 20, 10 meter phone, and 147.375+ rptr. For a certificate, send a 4 x 9 SASE and contact number to ***NKARC, P.O. Box 1062, Covington KY 41012-1062.***

OCT 24-25

BROWNSVILLE, TX The South Texas ARA (STARS) will operate N5CAF Oct. 24-25 from 1500Z-2200Z to commemorate the Border Air Fiesta II, sponsored by the Confederate Air Force's Rio Grande Valley Wing. Voice operation on HF will be on 21330 MHz or 28425 MHz, depending on band conditions. Contacts via a UHF remote link will be attempted with CAF pilots in flying aircraft. Listen for the CAF B-17, B-25, P-51, C-47, etc. For a photo QSL, send your SASE and QSL to ***Dr. David Woolweaver K5RAV, 2210 S. 77 Sunshine Strip, Harlingen TX 78550.***

COOKEVILLE, TN The ARS of Tennessee Technological University (WA4UCE) will operate an SE Station in conjunction with the Tennessee Technological University 47th Homecoming celebration. Operations will be on the General portions of the 80, 40, 20, 15 and 10 meter bands, and the Novice portion on 10 meters. For a certificate, send QSL and a 9 x 12 SASE to ***TTARS, Tennessee Technological University, Box 5262, Cookeville TN 38505.***

OCT 31

ST. PAUL, MN Station W0AA will be operated from the St. Paul Civic Center, by the S.M.A.R.T.S. RC, in conjunction with the Hamfest Minnesota & Computer Expo. W0AA will operate on the lower 25 kHz of the 20 and 40 meter band and on the Novice and Tech portion of the 10 meter band. Time: 7:30 AM-3 PM CST. For QSL, send SASE to ***WØAA-Hamfest Minnesota & Computer Expo, P.O. Box 5598, Hopkins MN 55343.***

OCT 31-NOV 1

BREVARD, NC The Transylvania County ARC will operate K4AIF to celebrate Halloween from the Devil's Courthouse in Transylvania County. Operating hours will be from 2100Z Oct. 31-0200Z Nov. 1. Frequencies: 3.860, 7.243, 14.295, 21.365, 28.335, 144.25, all SSB and 146.52 (FM simplex). For a certificate, send a legal size or 9 x 12 SASE to ***K4AIF, Dick Gustafson, 302 Wilson Dr., Brevard NC 28712.***

Never Say Die

Continued from page 4

cover design, advertising and ad sales, dealing with printers, how to handle trade shows, make travel arrangements, write subscription, renewal and collection letters, establish ad rates, design media packs, develop direct sales, deal with newsstands and distributors, handle fulfillment of subscriptions, decide on publication size, buy paper, learn how to deal with dishonest competition and their lying circulation numbers, do cost accounting, photography, artwork, halftones, color separations, and so on. It's an endless learning experience because as soon as you get to be an expert on the subject, the technology changes.

Publishing was mostly done on sheetfed presses when I started *73* back in 1960. The type was set on Linotype machines in lead slugs. Hot type. Then came cold type and Varitypers as the printing changed to photo-offset in the 1970s. IBM jumped in front by automating their electronic typewriters and running them from a magnetic tape—I got one of the first IBM Composers and got very good at using it.

Next came Compugraphic and the Photo Typositor, with an even more advanced system. That put IBM out of the typesetting business. Then, in the late '70s and early '80s, computers made typesetters more and more intelligent. By the last of the '80s our little microcomputers were powerful enough to take over. Today most publishers are using Macintosh desktop computer systems. They set the type and even lay out the pages.

This column is being typed on my Mac PowerBook 100, a little laptop computer. The finished editorial comes out of my computer in columns, with the spelling checked, the lines justified and hyphenated. It prints out on my little desktop LaserWriter just as it will appear in the magazine. These pages are photographed and from those negatives the offset printing plates are made to print the magazine.

As a publisher I've had to learn everything about the business. I've read books, magazine articles, attended workshops, talked with other publishers and so on. Learning how to build newsstand sales is not easy. Like almost any business, the whole system is infested with sharks, all waiting to screw the hell out of you if you don't know what you're doing. I don't know if 10% or 20% of the people in any business are basically crooked or not, but the percentage is high.

These days I give lectures at colleges on what an editor does. There's much more to being the editor of a publication than correcting spelling and grammar on submitted articles. An editor has to be up to date on the technology being covered. The editor should be soliciting articles—should know the pioneers and movers in the field personally. The editor should know the key advertisers and their products. The editor has to know if a submitted article is technically correct or not. We've seen egregious examples of editorial stupidity in the audio field of late.

Heck, we saw the ARRL and *QST* get gulled into helping promote compandered sideband. The bright side of that seems to be that they may have helped suck UPS into believing that this technology would help them use the 220-222 MHz band for their communications. A few million dollars later and they've given up. Snort, chuckle. If UPS had been smart enough to take a look at where communications technology is headed instead of where it had been, they'd have opted for an all-digital system.

Even the Japanese have been blind to this, investing billions in analog high definition TV. They may have beaten the heck out of us in consumer electronics production, but they're making cataclysmic marketing mistakes which give us all sorts of opportunities—all of which we've managed to miss so far.

Just look at the way they shot themselves in the foot with their Beta vs. VHS battle, which held back the VCR market for several years. They managed to agree on CDs, so that was the fastest growing new consumer electronics industry in history. Now they're at it again with their digital compact cassette (DCC) and mini-disc (MD) technologies. These will not only damage each other, they're going to seriously set back CDs in the process.

Any business you get into in your spare time will be a learning experience which will help free you from the fear of being out of work. It's money in the bank. And, of course, once you begin to know your spare-time business it's going to expand and you'll get the heck out of that old nine-to-fiver and never have to worry again about being fired. Oh, you'll have a new bunch of worries. And you'll be working 100-hour weeks instead of 30 or so. But you'll be having the time of your life. Only your wife and kids will notice. Unless of course you entrap them in your newfound fun and they're a part of your new business.

I keep plugging for publishing because there's such a tremendous need for information. I've a list of dozens of new publications that are needed. Like there's this inventor Ovshinski out in the Midwest, who came up with Ovonics around 20 years ago. He was on to something, but he never really got anywhere because there was no publication to provide information on his Ovonic developments. You'll see his technology in Ovonic photo-electric panels, but not much else.

New technologies desperately need supporting publications. Any growing field needs information resources to feed the growth. Pick a new industry, become an expert, and start publishing. Or just start publishing and then become an expert, the way I did with computers and digital audio.

When I published the first issue of *Byte* I didn't know squat about computers. Within a year I was lecturing on 'em. Within two I'd started two more computer magazines and was putting on a major industry computer show at the Boston Commonwealth Pier. But without all I'd learned about publishing by starting *Amateur Radio Frontiers* in my spare time, none of that would have been possible.

There isn't one thing that I've done that anyone else couldn't have done. I just used my time differently. I used it to create things and to learn. I do read a lot. I just counted and I've got over 50 six-foot bookcases full of books I've read. That's about one bookcase a year for the last 50 years. That's a little more than the average person in *Who's Who* reads—they average about 20 books a year. I seem to be running more like 10 books a month, but then there are an awful lot of things I'm interested in. My recent orgy of reading as homework for my report to the New Hampshire Economic development Commission got me into a bunch of new areas.

If you're even remotely in danger of being unemployed as a result of changes in technology or business, you could do worse than look for a spare-time business to start—and use as a learning tool. We don't need management layers these days when we have faxes, answering machines, cellular phones, BBS, pagers, conferencing, voice mail, Fedex, UPS, computers and so on. Business is changing and we either change with it or we're in for a cold, hard shock as we line up for those old unemployment checks and start wondering what in heck happened.

It doesn't make any difference how well you can do a job that isn't needed anymore. Or one that can be done for half the price or less in Mexico. Or one that can be done cheaper and faster by a computer. Where are those endless rows of statisticians and people at adding machines in insurance companies? Well, they're sure not doing that kind of work anymore. So how secure is your job? If it blows away, have you a parachute ready? Have you been building other skills and interests?

Amateur radio is a wonderful spawning ground for new ideas. It provides a fantastic opportunity to learn, both from books and by doing. The early ham repeater aficionados easily went into cellular radio and two-way radio sales and service. Others just blathered and still have a problem coming up with their membership dues for the ARRL every year. Once you have some skills and know what you're doing, you'll never be short of money again. You'll be able to zip over to Europe or Asia if you want. You'll be able to go on a DXpedition to some rare spot. You'll be able to buy that new ham rig. Any new ham rig.

Mail order is coming along fast, opening up many opportunities—even in amateur radio. I started my first mail order business when I was 12 and I'm still at it with Uncle Wayne's, Music/NH, and things like that. Mail order will either teach you a lot about advertising or punish you endlessly. You'll learn about using direct mail, 800-numbers, inventory control, just-in-time deliveries, pricing, offshore manufacturing, importing, exporting, writing and designing catalogs, printing, bulk mailing, and so on. And you'll start building quite a library.

No, as an entrepreneur you won't have as much time to spend adding to the pile-ups or babbling endlessly about nothing much to people you don't know and probably won't talk with again. If the shoe fits you can get mad. I'm used to that and won't mind.

Sudden Death

There's one more benefit to building your skills. This has to do with your sense of self-worth. People who have low esteem, such as those who are retired, have a much higher incidence of fatal heart attacks. Since your sense of worth helps keep you alive, perhaps it's worth an investment of your time.

It turns out that our feeling of being useful has a lot to do with our staying alive. Well, it makes sense, from a survival of the fittest point of view. Once one is no longer useful, why not die?

A Business Opportunity

Okay, all you incipient entrepreneurs, you've been pestering me for ideas for new products. No, it isn't a ham product—not for the really big market—but you can make a ham model that ought to do well, even with the bunch of frugal (cheap) old hams we still have left making a mess of our bands.

The idea for the product came out of my research into what's gone wrong with our American educational system. Mostly it's an old socialist-oriented system, based on the factory approach to teaching. We need to admit, even in educational circles, that capitalism has won over socialism and start phasing out our failed social experiments—like our public schools.

In Japan, where families are far more involved with their children's education and far less involved with nightly family hypnotic sessions watching sitcoms and ball games on TV, complete with six-packs, the families make sure the kids understand the importance of education by providing each of their children with a desk for doing their homework.

The product then is a kid-sized desk, complete with the best lighting for doing homework. Make it sturdy, not out of cardboard. Give it places to keep things. Make it deliverable knocked-down, but simple to assemble.

With the increased parental interest in helping their kids do well in school, you should have one heck of a market for these and sell 'em by the zillions.

The ham version should be designed to fit today's miniature rigs, not the kluges of yesterday. You don't need (or even want) space for the linear—that should be kept far enough away from the operating position so that the 60 Hz magnetic field from the power transformer isn't messing with your few remaining functional brain or other cells. Our cells tend to self-destruct around strong magnetic fields.

On the ham model I'd slant the desktop to allow the face of the rig to be easily accessible—and leave room in the back for the cables. You need room for a packet unit, plus a shelf for a computer.

But the parent market is the big one. Every kid should have a well-lit, dedicated study desk and a quiet place to use it. Now, can you bring in the economy model for under $100 retail? Plus shipping, of course. The deluxe model, with drawers and shelves, should do well at around $299. And a matching comfortable chair for an extra $49?

Are You Mad Yet?

With the ARRL doing every bit as good a job of running amateur radio as Bush is Presidenting our country, our hobby, as well as our country, is in the soup. The bad guys have taken over Congress and are running the country like a Western town in the hands of the saloon owner. The administration hasn't the guts to do anything. And the closest thing we've got to a masked man to help us out is Perot. In amateur radio the bad guys have control of 20m and 75m, and a good foothold on 2. No masked man there either. And certainly no one in control. Please let me know when you're mad enough to actually do something about it!

I was just reading the FCC docket having to do with relaxing our non-commercial regulations. I got a huge laugh when I read, "The League states that its suggested amendment would not subject the service to exploitation because the self-regulating character of the service would provide the proper checks and balances." What dream world were they in when they wrote that bunch of hooey? Self-regulating? Har-de-har-har. Self-unregulated is a more apt way to put it. Obviously no one at the League has turned on a receiver in years, nor have they, from any indication I can see reflected in *QST*, been even opening their mail. We're as self-regulating as the New York City ghettos.

They did a film on the conversion, during the last two or three years, of Manchester, New Hampshire, from a relatively crime-free city, to one of crack houses and prostitutes, with the police apparently unable to stem the tide. As in many other cities where this change has taken place, the local citizens have mostly fled to the suburbs. But a few have refused to be cowed. They're fighting back. They're writing down the license plates of john's cars. They're setting up neighborhood action groups—and they're having some success.

I've been hassling the ARRL for several years now to organize a self-policing system which would help clean out the garbage on our bands. Well, obviously they aren't going to do anything, so it's up to you. We need to form some posses to go after our bad guys. And I'm not talking about just documenting their evils and turning the dossier over to the FCC for action. I'm talking about us doing the action.

We need to pinpoint the bad guys. Fine, let's start by setting up a high frequency direction finding network. From there we can get local groups to find out exactly who is trashing us. Once we know that it's time to get the posse together and visit the low life en mass. This will have an effect 90% of the time.

But suppose it doesn't, then what? Hey, you've just begun to fight. How about a little neighborhood newsletter delivered to all his neighbors, telling them what he's been doing? This will put pressure on him through his family. How hard can it be to find out where he works?

I'll tell you this, if I lived in the city and prostitutes started setting up business near me I'd be out there with my camera, snapping pictures of every car that stopped to talk with them. I'd get their home address from the city records and send a picture to their wives to let them know what their husband's doing. I might even print the pictures on postcards. Snicker.

You remember when people would take your picture walking along the street and then hand you a card telling you where you could get a copy? I wonder if the johns might want to spend $20 for a photo of them talking with a prostitute from their car? You might be able to generate a very good business that way—make several hundred dollars a day. If they don't pay the $20 their wife'll get the picture. It's my entrepreneurial twist of mind—I can't help it. Why not make a buck and do good at the same time? If they can afford $50 for the prostitute, they've got an extra $20 for you.

Anyway, there's plenty we can do to clean up our bands—but we have to want to enough to make the effort. We have to care. I think it's clear to even the most fuzzy-minded hams that the ARRL isn't going to do squat—and we know the FCC would rather just close down the bands than spend the money to police them. It'd be cheaper—and then they could auction them off and put a few billion into the treasury for Congress to send to some lousy dictator, or to build useless dams. They spent a few mil building a totally unneeded dam in Peterborough, courtesy of the political clout of Senator Cotton a few years back. Great pork project. Buncha crooks.

It's all up to you. I've explained how you can reclaim our bands from the bandits, but you've got to stop grousing and actually do something. The meek do not seem to be making much progress in inheriting the earth. They're more giving ground.

How The Brain Works

It might be closer to entitle this piece "Why we're all crazy." That's more the normal journalistic style—go for people's attention. Well, it works for the *National Enquirer*, right?

Though we tend to constantly look for similarities in people—things with which we are familiar—we have to admit that everyone is different. Some are a lot different, some just a little. Those who are a whole lot different we label as crazy. But it's all just a matter of degree.

And that raises the question, how come everyone is so different? And when someone gets too different is there anything we can do about it? Or do we have to lock 'em up and do our best not to be bothered? Of course once we understand why people are different, that'll presumably help us not only repair those who are the most screwed up (different), but might also help anyone with a less than optimum response to things.

To understand how our mind works we have to start with some very basic concepts. Also, I hope the concept that the mind and body are parts of the same organism and can't really be considered separately won't strain you. When I refer to the mind, that's shorthand for mind/brain/body.

Law One

All living things obey one universal law, the law of self-preservation. It's a good basic law and the one from which the other natural laws developed. Once you have that one law, the others are inevitable—such as survival of yourself through your children—and the survival of all living things through natural selection and the survival of the fittest.

Now, if you were going to design a living thing of any kind, you'd build in the self-preservation law as part of the most fundamental programming. You'd hard wire that into the computer system. Computer system? Well, all living things seem to be able to be aware of other living things and react to them, from amoebas to trees—even most people. That calls for some kind of intelligence that we don't see in a rock—or on 14.313 kHz. So let's, for simplicity's sake, compare whatever living things use to be aware of other things and react to them to a computer. It'll greatly simplify my job of explaining how people work. If you understand about programming computers, that won't hurt either. That means understanding about hard-wired instructions, machine language, and so on.

So let's start by comparing our brain to a computer. And that's mostly what it is. No, it isn't digital. We're just beginning to discover how the fool thing really works. We have discovered that it's awfully complicated, but we haven't even located exactly where memories are stored or in what way they're stored. We know, but don't like to admit, that not all brains are equal at birth. There's a little matter of genetic design, with everyone being a little different. That "all men are created equal" stuff is baloney and gets reason-challenged people into all kinds of trouble. Some people start out with better brains.

Alas, by the time the kid gets squeezed out into the world some nine months later, the environment has already had a good (or bad) head start on programming. Now, if you use common sense (whatever that is), or understand computers, you know that the earlier the programming, the more influence it has on the end ability of the computer to function effectively. Well, you're going to hate the concept, but that's the way it is with kids. That nine months sloshing around, getting occasional poundings from dada as he sees how close to birth he can continue sex with mommy, and other discomforts, all are programmed into the developing computer system.

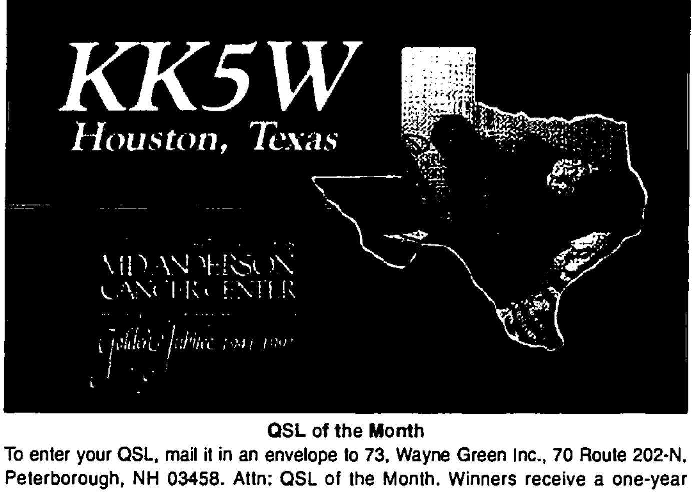
Yes, that little fetus can hear what's going on. No, it can't think yet. But it can and does react to noises, drugs, and other disturbances. The real downer is that little icky in there is busy recording a lot of that noise—and that includes voices. Ask me how come the fetus does something like that.

Let's go back to Law One, self-preservation. Well, if a living thing is going to preserve itself it has to avoid getting killed. Make sense? And what helps living things avoid death? Senses. Like for instance pain. We have a built-in pain sensing system to protect us from hurting ourselves. We go to rather great lengths to avoid pain because that's equated with non-survival on a very basic level.

Now here's where things get screwed up. The basic idea is a good one. The stove is hot and you get burned if you touch it. So you quickly learn to keep your wandering fingers off stoves. You avoid the pain—and that helps you keep 10 operating fingers—at least until you take shop and are inattentive for a moment.

The hard-wired programs in our computers have an instruction which says that when we feel pain we equate that pain to our other perceptics. This is a way to help us avoid the pain a second time. So if we see a stove or hear a kettle, or whatever, we don't have to consciously consider whether to draw back those fingers or not, we get 'em the hell out of there fast and think about it later. This doesn't happen on a conscious level, it's subconscious. Well, the difference in time between the two functions can save your life, so that's a good basic program.

The pain sets up this sort of look-up table in the subconscious mind which has a little bunch of neurons equating the perceptics registered at the time of pain. This is not a thinking operation, it's entirely automatic. Alas, as Congress has proven to us endlessly, even the best of laws tend to have bad consequences. And this basic response has some terrible consequences. The basic idea



QSL of the Month

To enter your QSL, mail it in an envelope to 73, Wayne Green Inc., 70 Route 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to 73. Entries not in envelopes cannot be accepted.

probably works fine for trees and amoebas, but by the time it's applied to humans it's in need of some serious updating. But changing a basic law is far more difficult than tinkering with the Constitution—like trying to pass a law preventing Congress from spending more money than we have.

The problem is that it doesn't take long before there are thousands of these memory circuits, all warning us to avoid sounds, sights, feelings, and so on. Then tens of thousands. Yes, it's possible to go into the mind and erase these fool equation circuits and when we do the person's IQ zooms upwards as more and more of the mind is available for thinking and no longer tied up with all that garbage.

The basic instruction says we're to avoid pain because pain can lead to death. Maybe you've noticed—all pain isn't physical. We suffer emotional pain too. And yes, the brain treats emotional pain exactly the same way it treats physical pain—it sets up a circuit with all the perceptics dutifully recorded that went with the pain.

Does all this make good sense? And now can you see why, with subconscious messages to avoid this and to avoid that, we are so irrational? That's the way we've been programmed. We don't know why we are uncomfortable when we hear a certain sound. We don't have a clue that a sound pattern can trigger our reactions. Sound pattern? Do I mean like the pattern of some words? Bet your bippy I do.

So let's go back to that fetus recording sounds when it registers pain. It's like a tape recording. There's no understanding of what the sound pattern means. That comes later, and still on a subconscious level, where the sounds still have no way to be translated into a consciously understood meaning. But, whooey, can they have an impact on our lives!

Hypnotism

If you know much about hypnotism you know that people can be made to do things they wouldn't normally be able to do—and then later have no recollection of doing them. You can tell a hypnotized person that when they wake up they will not be able to see a certain person in the room. And they won't.

You can tell them that when they've been brought out of the trance they'll take off their jacket when you touch your sleeve—and put it on again when you touch your throat. You wake them up and they'll be taking off their jacket and putting it back on a dozen times, each time coming up with what is to them a rational reason for it. After a while it'll finally become apparent, even to them, that something's amiss. But meanwhile they will sincerely explain their actions and believe what they are saying.

The subconscious works that way. The sorry fact is that we can't believe our own conscious minds. We're constantly lying to ourselves and others. This has a lot to do with why none of today's psychotherapy has much of an effect in changing people. We don't consciously lie, but on the subconscious level the lying is endemic as these protective pain avoidance circuits kick in and out.

The Good News

Yes, it's possible to help others to erase those darned pain avoidance memory circuits. I know how to do it and I'm very good at it. It takes a little practice—practice and a solid understanding of what you're doing. No, you can't do anything to help yourself—it's that conscious mind of yours, which will protect you until your death. The therapist has to bypass the conscious mind and work entirely with the subconscious—which fortunately is simple to do.

The Bad News

As far as I know, no one is available anywere who knows how to do this. There used to be a few people who were very good at it, but most of 'em are dead now—and I'm not looking so good myself. The other bad news aspect of this is that once you understand how to repair screwed up brains, you also have a key to use your knowledge for evil. One chap, who I knew quite well, did this and made billions.

Wow, billions! Does that get your envy working? I think that's one of my problems. I haven't any envy. I can't think of anyone in the world that I envy—or that I even remember envying. I know a bunch of multi-millionaires and even a billionaire. I wouldn't swap with any of 'em.

Yes, I can tell you how to help others with psychological problems. But you'll find the same thing I did. People's conscious minds are so protective that they'll do almost anything to avoid cleaning out the circuits that are screwing them up. They'll take off and put on their jackets for years, coming up with fresh excuses each time—excuses they really believe. And they'll get into lousy relationships, act irrationally, and make a mess of their lives and those around them. But get help? Har-de-har. It's the same with drug addicts who are the last to admit their addiction—to crack, nicotine, alcohol.

So I'm not sure why you'd want to bother learning how to help people when so few are willing to be helped. And you can't help yourself. Of course, if you work with someone else, you can help each other, which works out well. The problem with that is that you can't ever work with someone who is afraid of what you'll think. This erects a wall. It really has to be a stranger to work well. And once you get familiar with the process you can go in there and clean out whole messes of avoidance circuits in short order. You can actually help 100% of the people you work with and do in hours what other therapies only hope to do in months or years.

I've helped well over a hundred different people so far, so I have some interesting anecdotes. No, I haven't time to go back into that business, so don't ask. But I will say that very few chronic illnesses are unavoidable. Every illness has a psychological component—an easily found and erased component—once you know how.

Explaining how to repair the mind isn't as easy as explaining how it works and how it gets so screwed up, so it'll take a good deal of whining and complaining to get me back to my word processor to tackle that topic. I expect I'll get a lot more "I don't always agree with you" baloney. As soon as you've done as much research on the subject as I have I'll respect your opinions—if you can back 'em up with facts or experimental data that is repeatable—which I can. My concept of how the mind works not only makes sense, but once you understand the concept, you can see why it has to be that way. It explains everything we see happening, with no loose ends or anomalies.

Those Crowded Bands

What's all this phony-baloney about us needing more hams when our bands are so crowded that making uninterfered-with contacts is almost impossible? Sure, I get letters from readers all the time, demanding that I stop, already, with my endless push to attract more hams to our hobby. We just haven't any more room for them!

Indeed, this has been an ARRL director beef for the last 40 years. My complaining readers have apparently convinced themselves that I'm pushing for more hams so I'll have more subscribers to *73* and make more money. Well, perhaps the director mind-set explains why the League has done almost nothing to attract more youngsters, despite endless promises. Oh, oh, there goes Wayne trashing the League again! Trashing? I suppose saying the truth is considered trashing, particularly by people who don't want that truth known, or at least don't want to face it.

So let's take a look at our bands, just to get some perspective on how crowded they really are. Should I start at the high end, or the low? If I start high I'll lose your attention fast since we have so many totally unused megahertz up there, so let's begin with 160m. Here we have a 200 kHz chunk from 1800-2000 kHz. Of course I can remember from when the phone band went from 1800-2050, and every kc was packed solid with AM signals every evening. The CW band went down to 1715, but had little activity.

Loran has so chopped up the band that it's never been very popular in the last 50 years. Satellite positioning technology will eventually clean out the old Loran garbage and leave us with a clean band. I've made occasional forays down to 160m, but I've generally gotten discouraged by the noise. I'd be interested to hear from 160m denizens about how serious the QRM problems are these days—and how much the Loran noise has abated. Is QRM a major problem?

That brings us to 80m, where we have some CW traffic nets, a cluster of Novice CW, Canadian phones, and then a horrendous mess we call our 75m phone band. There's a small, hardy group of 75m DXers who haunt the lower end of the phone band, trying to sift weak DX signals through the Canadians. I used to have fun doing that, often luring European and African ops down to 75m from a 20m contact. I'll never forget the excitement when I was talking on 20m to my home station while visiting Central Australia (VK3ATN) and we went down to 75m and there was my W2NSD/1 signal, roaring in 5-9+. Wow!

75m is fairly crowded, but fortunately most of the activity is stacked up into round tables, so around 80% or so of the ops are listening at any one time. Any time you get fed up with the QRM in the phone part of the band you can plug in a computer and move down for some nice high-speed CW or RTTY round tables in the more open parts of the band.

40m. Sigh. I gave up even trying on 40m a long time ago. How about some aficionados reporting on 40m today? Where's the DX action on CW? Where are the traffic nets? RTTY? Slow-scan? Yes, I know where the phone band is—up there in that shortwave broadcasting cacophony.

Then there's the 10.100-10.150 kHz band. 50 kHz. Much QRM there? Maybe I should start a series of weekly 30m contests, with separate awards for CW, RTTY and packet? Heh.

20m. Ha! Yes, the phone band is often a mess. There are the Canadians, then the DXers, then slow-scan, then some nets, then comes the K1MAN and KV4FZ sewers. Below the Canadian phones you'll find RTTY and high-speed computerized CW and some wide open spaces where CW fans are able to work DX with very little QRM.

The 18.068-18.168 kHz band, if anyone has been able to find it, is another ITU band for CW fans. What's doing there?

15m keeps fairly busy these days, but I don't think we're going to hear much complaining about QRM.

The sun spots have been keeping 10m busy, but it's nothing like the old days. I remember back in 1946 when 10 was packed solid with AM signals whenever it was open. 28.5-29.0 was kilowatt alley. Is anybody complaining about QRM on 10 these days? I suspect we could quintuple the activity without causing too much aggravation.

Six meters was once packed with Techs between 50-52 MHz, but that was before repeaters sucked 'em all to 2m in 1970. There's not a lot doing on 6 these days.

Twenty years ago the move to repeaters on 2m was new technology. Since then we've remained technologically frozen. The rest of the world is moving to digital voice, but we're still hanging on to NFM which, by the way, I helped pioneer back in 1946. After 46 years it's almost time to start thinking of moving ahead in technology. But then we have a lot of old-timers who are still hung up in the 1930s with CW—apparently unaware that amateur radio is the only service left using this molasses mode.

As I travel around the country I check into every repeater I can reach, asking if there's anyone around. There rarely is. From what I've seen, 95% of our repeaters could be shut down and no one would really notice. Most of 'em seem to be exercises in ego extension, not communications systems with any real pur-

pose. Heck, I've got one myself which I doubt I've used once in the last six months. It serves greater Hancock, NH.

We could free up 90% of the 2m band if we stacked all of our unused or seldom-used repeaters on one channel, so don't whine to me about 2m being full. Balderdash.

Then comes our 220 band—the one the FCC sliced 40% off of for UPS, and which it now is beginning to look as if they're not going to need. Well, I warned 'em about how useless compandered sideband would be, but they had to find out for themselves, no doubt at great cost. Digital is the way to go, not SSB. We'll soon be seeing all of our FM broadcast stations going digital. I can remember when hams were the pioneers in any new technology, not the very last to change. What a comedown for us. Despite our cries of anguish over losing part of 220, the fact is we used very little of it for anything practical.

450? This is used mostly for repeater links and a few remote base stations. There's little on 450 that couldn't be moved to a higher band. Indeed, if we moved all of the repeater links to 10 GHz, we could put almost all of 'em on one single frequency with directional antennas and not have any interference between them.

We'll probably lose 900 MHz through a lack of use. And from there on up we've little going. We do some moonbounce at rare intervals on the high end of 1200 MHz. How many of you even noticed when the FCC took away 25 MHz of this band? The 2.3 and 3.3 GHz bands are empty. A few years ago Chuck Martin KO1I put together a couple simple 10 GHz transceivers—tenth-watt jobs. With these we made contacts between New Hampshire and all six New England states, plus New York. It was fun and it showed what could be done on this band with inexpensive gear. No contact was under 50 miles and one was well over 100 miles!

If we encourage new hams to start playing with our microwave bands they'll have fun and we'll have a better chance at defending our right to these bands, which would be worth billions if they decided to auction them off. We need some kits to help youngsters get started—and we need a lot of articles telling 'em how to go about it.

As a side note, Chuck and I had so much success on 10 GHz that Chuck wanted to try the same stunt on 24 GHz. Unfortunately, the parts to do this had to come from Microwave Associates and a ham there stopped the process. He was an ARRL stalwart and didn't want to see *73* get credit for the pioneering. The result was that no one has ever done it. I hope Freddie is happy with himself and his great contribution to amateur radio.

The sorry fact is that only a tiny percentage of our assigned bands are being used. 20m is packed. But then when I started in the hobby in 1936 20m was packed. Nothing has changed. 75m is packed. It was packed in 1936 too. That hasn't changed either. In those days 10m was the microwave band, with just a few daring pioneers working at getting it active. The first ham I ever visited, Harry Stevenson W1CUN, from my home town in New Hampshire, was pioneering that band back in 1935.

We have 10 times as many hams now as we did 50 years ago and, as far as I can see, 20m and 75m aren't any the worse off. As we get more hams they tend to move to the bands where crowding isn't as serious. So, even if we have 10 times the number of hams that we do today (which I think we should), 20m isn't going to get worse. As a matter of fact, a little added pressure and an influx of young experimenters might just help us develop some new modes which would allow us to sandwich in 10 to 100 times as many stations in our same bands, and probably with a lot less interference.

As we go digital, complete with compression algorithms, and probably with time division multiplex, we'll be entering a whole new world for SSBers to try and jam. 73

Loop Antennas

Continued from page 28

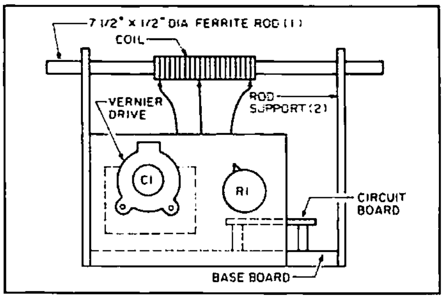


Figure 3. Simpler alternate design.

the longer the core the larger the capture area (aperture).

A friend gave me a dozen 1/4" diameter by 7-1/2" long ferrite rods with a permeability of 1800. I cemented seven of the rods together to form a core cluster 22-1/2" long. This scheme can be used with miscellaneous lengths and rod diameters. For best structural and electrical reasons, the joints in the rods should be staggered. See Figure 4.

WARNING: Ferrite rods are very brittle, like fine porcelain, and extreme care should be used in their handling. Dropping a rod is sure disaster!

I used the regenerative circuit on several of my open wire box loops, one low frequency and the other medium frequency, by adding a proper source tap. Again, the results were excellent. The source tap, for instance, on a 20-turn loop, would be at five turns.

I might mention that when the circuit is in oscillating condition, it can radiate a signal that could cause local interference (probably more so with a box type loop due to the larger aperture).

When a regenerative device such as the loop described here or a regenerative preamplifier is used with a conventional receiver it will be more effective to place the receiver in manual volume control. Turn the audio gain full up and use the RF gain control for comfortable listening. When the regenerative amplifier is in oscillating position, or near so, it can trigger the automatic gain control (or AVC) and it will deaden the receiver's response and may take several seconds to recover. This can be most annoying when you are tuning the amplifier circuit at its threshold.

In conclusion, the regenerative loop, compared with a straight preamplifier, far exceeded my expectations. While not providing the volume with the receiver using an outside longwire antenna, the loop does not have the susceptibility to local neighborhood electromagnetic interference that you would experience with a longwire, and the directional characteristics of the loop can be an important advantage.

If you like loops, try this scheme and you will be in for a big surprise. 73

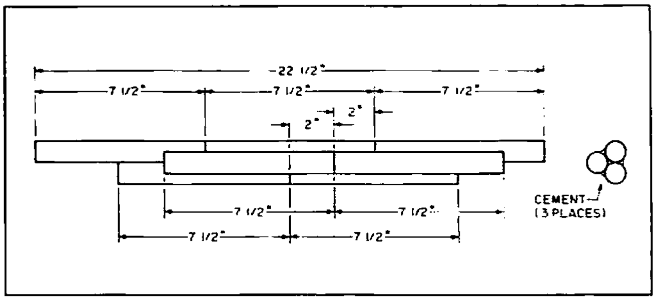


Figure 4. Multiple ferrite rods can be stacked as shown to increase the capture area (not to scale).

Parts List.

C1	365 pF variable (see text)
C2	220 pF disc ceramic
C3,C4	0.1 µF
C5	0.01 µF
R1	5k potentiometer
R2	1 MEG
R3,R4	10k
R5	1k
Q1	MPF102 FET
Q2	2N3904 NPN transistor
L1	#28 enameled wire (see text)
Misc.	Ferrite rods (3/8" to 1/2" dia., 7-8" long)

Ferrite rods can be obtained from Amidon Associates, P.O. Box 956, Torrance CA 90508. Phone: (310) 763-5770. An appropriate one for this antenna is their part number R33-050-750, a 1/2" diameter by 7.5" long rod with a permeability of 800; available for $18.

ATV

Number 23 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

ATV Contest

The Indiana Amateur Television & UHF Club is holding their second ATV contest during the entire month of November. An ATV contest like this should help stir up activity and help inspire ATVers to improve their stations, thereby improving their DX capabilities. The object is to work as many ATV contacts as possible on frequencies of 420 MHz and above. The contest starts at 0500 UTC on November 1, 1992, and ends at 0500 UTC on December 1, 1992. Anyone in the world is welcome to submit entries.

Power Categories

To help even the odds against the Big Gun stations, there are four categories to choose from, based on your peak power level: Class I is for stations using less than 5 watts, Class II ranges from 5 to 34.9 watts, Class III from 35 to 99.9 watts and Class IV is for operators using over 100 watts.

Exchanges

Only confirmed two-way ATV contacts of 10 miles or more will count (stations operating under 5 watts have no minimum distance limit). No repeater, balloon or airborne contacts will be allowed. To enter the contest just keep a log of your contacts with the following information: 1) Callsign contacted, 2) QTH contacted, 3) Distance in statute miles (provide the latitude and longitude of the contact and your station, if possible), 4) Picture rating (P-level), 5) Power level used, 6) Time (in UTC) and date of contact, and 7) Frequency used.

Scoring and Entries

One point will be awarded for each statute mile between your station and the other station. Only one contact is allowed with the same station on one band. Contacts with the same station on different bands will be counted, however.

To enter the contest, just send your logsheet (see Figure 1 for an example) to Chuck Crist WB9IHS, 6455 Madison Avenue, Indianapolis IN 46227. All entries must be postmarked no later than December 15, 1992. All entrants should include their home phone number. Blank contest log sheets are available from WB9IHS if you send him an SASE.

The Awards

An attractive plaque is awarded to the winner in each power level category. Your name and callsign will be engraved on the plaque and you can display it proudly in the shack for one year (unless you win the next year as well). You will also receive an attractive certificate suitable for framing (see Figure 2). A separate award will be issued for the longest distance contact, regardless of power level. All awards will be issued during the January meeting of the Indianapolis ATV and UHF Club (you need not be present to win).

This contest should be a lot of fun It's a nice leisurely competition that should inspire you to dust off your equipment and warm up the frequency.

License-Free Video

I've received a number of letters asking where you can operate a TV transmitter without an FCC license. There are currently only a few frequency ranges that you can use: 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz and 24-24.25 GHz. Power levels are restricted to a very low level, measured as a field strength of 50,000 µV/meter at a distance of 3 meters (250,000 µV/meter for 24-24.25 GHz). This equates to a power level of approximately 2-10 milliwatts, depending on the efficiency of the antenna (usually a ground plane). Exceeding this field strength limit through modification of the transmitter or by using a gain antenna is strictly illegal. Harmonic content should also be down at least 40 dB from the center carrier. You can design and build up to five transmitters for your own personal use as long as you don't exceed the field strength limit; more than that number requires FCC-type acceptance or use of transmitters that are already type-accepted. The only way you can extend your range substantially is through the use of a good receive station with a gain antenna.

There are countless transmitter/receiver pairs available in mail order catalogs, local video/discount stores and Radio Shack stores that operate in the 900 MHz band. The units that I've seen use AM video modulation and are usually not crystal-controlled (some units do tend to drift somewhat). These are usually very reasonable and with modification could be the basis of an inexpensive 900 MHz ATV station (only if you have a ham license, of course).

A few years ago a number of devices showed up in the country that operated on the low UHF comercial channels (channel 14, for example). A few manufacturers offer kits that transmit in this range as well. As far as the FCC is concerned, you cannot transmit television at ANY power level on a commercial TV frequency and these devices and circuits are illegal if you use them.

If you don't have an amateur radio license, your best bet is to use the 900 MHz devices or get your license and come on over to the ham bands where you can run some *real* power!

Contest Log Sheet — Page ___ of ___
Start Date ______ 1992
Call ______
Location ______ Class Entry ______
Optional Info: Latitude ______ Longitude ______

Date	Contact Call	QTH	Name	Distance (miles)		RPT (P1-P5)		Power (Watts)	Time (UTC)	Freq. (MHz)
					Pts.	Rcvd	Sent			
				Total =						

Figure 1. The suggested logsheet for the ATV contest.

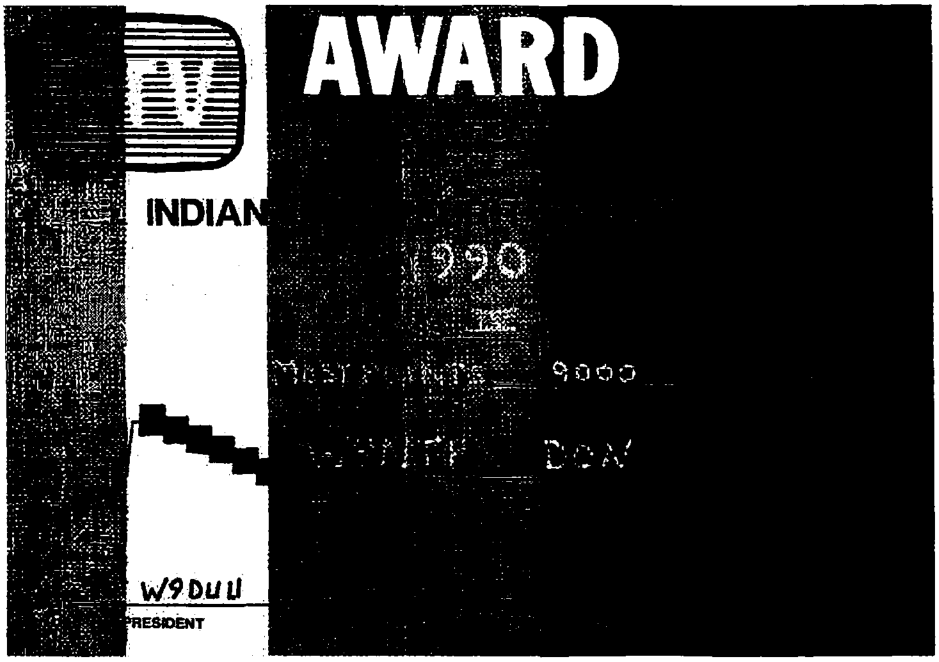


Figure 2. Win this attractive award in the ATV contest sponsored by the Indiana Amateur Television and VHF club.

Number 24 on your Feedback card

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DELAWARE

New Castle

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North Jersey's newest Two Way Radio and Electronics Dealer is now open. Sales of ham, business, marine and CB two way equipment as well as scanners, shortwave, electronic kits, antennas, books, cable boxes and more. Friendly service and low prices. **ADVANCED SPECIALTIES, 114 Essex Street, Lodi NJ 07644. (201) VHF-2067.**

NEW JERSEY

Park Ridge

North Jersey's oldest and finest Shortwave and Ham Radio Dealer. 1 1/2 miles from Garden State Parkway. Authorized Dealers for AEA, Kenwood, Japan Radio Company, ICOM, Yaesu, etc. Ham Sales, Lee WK2T. **GILFER SHORTWAVE, 52 Park Ave., Park Ridge NJ 07656. (201) 391-7887.**

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Central Ohio's full-line authorized dealer for Kenwood, ICOM, Yaesu, Alinco, Japan Radio, Standard, AEA, Cushcraft, Hustler, Diamond and MFJ. New and used equipment on display and operational in our new 10,000 sq. ft. facility. Large SWL Department, too. **UNIVERSAL RADIO, 6830 Americana Pkwy., Reynoldsburg (Columbus) OH 43068. (614) 866-4267.**

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DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '92 issue must be in our hands by February 1st. Mil to 73 Amateur Radio Today, 70 Rte. 202 N, Peterborough, NH 03458

Number 25 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: 6 meter AM gear. Also, 6m FM mobiles, 2m xtal and ICOM 21 series, VHF marine. Any reasonably priced VHF equipment considered. My wife and I are awaiting our callsigns and looking for an economical way to get on the air. *Rob Bellville, P.O. Box 892, Northboro MA 01532-0892.*

HELP—I'm looking for the operating manual for the Commodore 64 computer program "Contender Plus," including the instructions for the "Country Hunter" program designed by GRUMMTRONICS in 1985 or 1986, and presently distributed by HAM-SOFT. I can copy and return, or I will pay copy costs and postage. *Ed Quinn KB2NEK, 31 George St., Avenel NJ 07001.*

I need the manual or the circuit and pictorials for the Patterson PR 15 communication receiver (early WWII vintage). I'll be happy to reimburse you. *Charles Irwin W6GAD, 61083 Sandalwood Trail, Joshua Tree CA 92252.*

DXer desperately needs a 4-NB noise blanker for DRAKE R-4C receiver. Will pay reasonable price and postage costs. Please write to: *Ali Munir AP2AL, 39 Gulberg 5, Lahore, Pakistan.*

Wanted: Owners manual for a James Millen Grid Dip Meter, model 90662-A. Advise net cost to *Otto Grube N2RSF, P.O. Box 939, Cutchogue NY 11935. Tel. (516) 734-7095.*

73 INTERNATIONAL

Number 26 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

1992 BARCELONA WORLD OLYMPICS A MAJOR SUCCESS Guess what I was watching as I was working on this column? The pageantry was wonderful and the sports themselves were fascinating. It is always interesting to see whether the favorites will be successful or be upset by another athlete, and whether new Olympic or world records will be set.

But, are the finishers of the first three places, the medalists, the only winners? No! It has been said time and time again by many, if not all, that everyone is a winner; just participating in the Games makes everyone a winner.

We in the amateur community can look at the Games as something that some of us do every weekend or at least several times a year. How many of us get involved in contests at some time or the other? Aren't all of us trying to win something? Aren't we trying to show how good we are? Don't we all critique our performances after completion of the contest and figure how to do it better next time and then make plans to do it?

Are we any different from those athletes? Yes, but only in our physical prowess. What do the "losers" say or do? They use what they have learned from their experience and make plans to do better next time, learning from their mistakes. We do the same thing, don't we? By always striving to become better or do a better job we further our own knowledge and maybe even technology if we think of something new that has never been done before, such as a new type of antenna or logging program.

Plus, we have fun! Don't you think that the athletes who participated in the Games also had fun? I certainly do! And I always have fun when participating in Field Day or a VHF/UHF contest, or even ham classes for new hams or upgrades.

If you think being a ham is fun, why don't you share that fun with someone in the near future? Invite some of your friends, especially non-hams, to participate in your next ham venture. And if they show some interest in becoming hams, help them to the best of your ability. Our average age has been increasing because we are not bringing "new blood" into our hobby.

If you don't know what to do, please read what Rune Wande SMØCOP has to say about the subject in the section of this column from Sweden.

GET INVOLVED! 73 to all from Arnie N1BAC.

Roundup

Japan *From the JARL News:* **8J1RL Returns From the Antarctic** Mr. Toyoshi Arisawa JA4EDV, a member of the 32nd Japanese Antarctic Research Expedition Team, returned safely to Japan in March, after having stayed at Showa Base on Ongul Island since February 1991.

Mr. Arisawa, in the intervals of his regular duties (communication) as a member of the wintering party, operated 8J1RL, JARL's Antarctic station. Using HF and amateur satellite (JAS-1b), he exchanged communications with about 3,000 amateur stations in Japan as well as other countries throughout the world. In May 1991 he succeeded in making the first HF packet communication between Showa Base and Japan.

The following is the gist of Mr. Arisawa's message to all readers: "Many thanks for replying to my CQ. I imagine that other members of the wintering party at Showa Base are still calling CQ between Sunday evenings and Sunday midnight (Japan time) when they have relatively favorable conditions (mainly through 21 MHz). So please try to QSO by all means."

No More Press-To-Talk Button? No longer will it be necessary to press a button prior to talking to anyone, thanks to efforts made by Tohoku Electric Power Corporation which announced that they had succeeded, for the first time in the world, in putting "a single-frequency, two-way simultaneous communication radio equipment" into practical use. This mechanism works like a telephone because two-way communications can be made simultaneously with a single frequency.

The newly-developed radio equipment, when transforming, divides the operator's voice signals into 0.2-second segments and compresses them into half the time before transmission and allocates the other half of the time for receiving messages from the other party. Such equipment has not been put into practical use because of various difficulties, like noise caused by connecting compressed electric waves. Tohoku Electric has recently developed a new technology for the above.

It is said that this new technology can be utilized in many areas, including amateur radio.

Switzerland *From the International Telecommunication Union (ITU) Press:* **Republic of Slovenia ITU's 170th Member** The instrument of accession of the government of the Republic of Slovenia was deposited with the ITU on 16 June 1992, making the country the 170th member.

Slovenia is bordered on the north by Austria, on the northeast by Hungary, on the southeast by Croatia, and on the west by Italy. It has a land area of 20,251 square kilometers. Its capital is Ljubljana. It has a population of 1,974,839 inhabitants (1991).

Uruguay *Letter from Alberico "Bill" Lopez CX4GL:* I would like to make everyone aware of Grupo Uruguayo de Telegratia. It is the only CW Group in Uruguay, has been in existence since 1989, and offers an award (diploma) for CW hams around the world. If you wish more information about the Award program please contact Bill at 75001 Palmitas, Soriano, Uruguay, South America.

CANARY ISLANDS SPAIN

Woodson Gannaway EA8/N5KVB
Apartado 11
35450 Sta Madre Guia (G.C.)
Islas Canarias
Spain

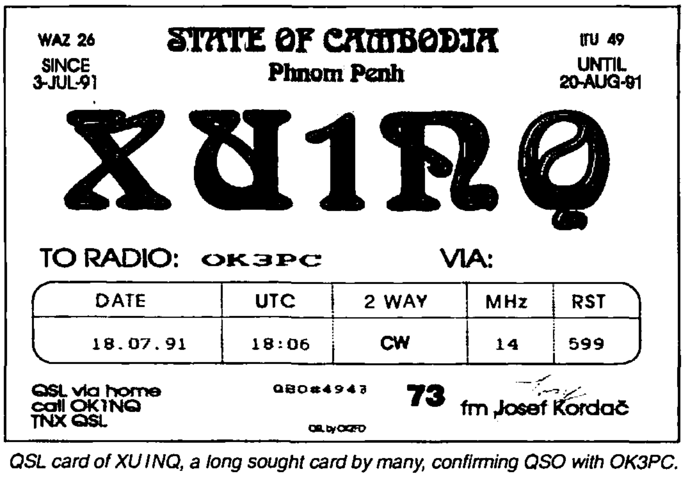
CONGRESO URE 92 DEL 4 AL DE OCTUBRE, LAS PALMAS DE GRAN CANARIA, SEDE SOCIAL DE LA URL. NOTAS DE INTERES: Las conferencias-coloquio estarán a cargo de especialistas en diversas materias de orden técnico y divulgativo, y están abiertas a todos los socios que deseen asistir y participar en ellas. Los conlenidos de las mismas y los nombres de los conferenciantes se darán a conocer en la próxima revista.

Los coloquios a cargo de especialistas son reuniones de carácter restringido sobre materias muy concretas.

A la AGSC pueden asistir todos los socios que lo deseen, si bien solamente tienen voz y voto los miembros de la misma.

Las reservas y el abono de los biiletes, se ha de estalecer directamente con: MAS, Operador Turistico, S.A., Teléfono 928-275821/31, Avada. Mesa y López, 45., 35010 Las Palmas De Gran Canaria.

[I hope that everyone understands the previous message about a ham radio conference in Las Palmas de Gran Canary from Woodson because I'm afraid that I do not speak or read Spanish. It was received by FAX and appeared to be something that needed to get into the October issue. Woodson says that there are no official provisions for translation during the conference, but foreign hams are most welcome and the local hams are always very helpful and hospitable. If you have any questions you may call the radio club (URL) at (928) 41 11 77 or FAX:(928) 41 84 25—Arnie]



QSL card of XU1NQ, a long sought card by many, confirming QSO with OK3PC.

CZECHOSLOVAKIA

Rudolf Karaba OK3PC
Gogolova 1882
955 01 Topolcany
Czechoslovakia

CQ CQ CQ de **XU1NQ** sounded for the first time in the morning of July 3, 1991, on 21 MHz by CW. In a few minutes all the people who were listening on this band "queued up" and the hunt for this cailsign began. Some stations were very carefully finding out if the cailsign was right and that they weren't working a pirate. I am not surprised because this "expedition" was not reported in advance.

A few years ago I dreamed about operating from some rare countries and I had the possibility to visit them later—ZA, 3W, 5A, YI, ET, D2, and also 3W in 1991, and then XU. I was unable to receive a licence in Hanoi so the only hope was to get to Phnom Penh. I reached Phnom Penh on June 21, 1991, and immediately I "started the action" of getting a licence. I must thank the head of our embassy who helped me very much. It was not easy at first to be refused but in the end it was worth it. I was allowed to choose the cailsign, but il could not have been used before. I was able to start operating from July 3, 1991.

I wasn't able to get much sleep because I wanted to make as many contacts as I could. I wasted much time by cooking and washing for myself, by necessary shopping, and an unsolvable problem—frequent switching off of the current for a few hours at a time each day. When this happened I disappeared from the band like a ghost. The summer is the time for rains, with at least one big storm every day with accompanying

QRN. Unfortunately, I had to sleep also.

I tried to be on the bands as often as possible. I was allowed to operate on 14, 21, and 28 MHz by CW only. The bands were mostly free in the morning. It was very interesting that the best conditions for Europe were in the evening and night, 1600-2100 UTC.

I gave priority to OK stations so I tried to get all of them on all three bands. I was hoping for at least 500 but only contacted 380 OK stations. There were great pile-ups, so QRP stations had to be patient.

The days passed so quickly and it finally came time to leave. I had made approximately 14,000 QSOs in 126 countries DXCC. I used a borrowed Kenwood TS-940AT into a log-periodic antenna directed to Europe. After four months away from OK I was looking forward to getting home, but at the same time I was sorry that XU1NQ would go QRT, maybe forever. My last QSO was with 3XØNHU on 21 MHz on August 20. The next day I departed for home through Moscow to Prague, where cases of QSL cards sent directly to my home were waiting for me. All of the logs that were written by hand while operating were transcribed into the computer and the QSL process was reversed. As many as 90% of the stations said that XU1NQ was a "new one" for them. It finally sunk in—I was a new country for many of them; it was very rare! From this point of view I can honestly say that "the expedition" was a success.

Many thanks to all for the QSOs, and to those I couldn't hear I am sorry, but I did the best that I could. 73 to all and I look forward to contacting many of you with my home call, OK1NQ. Josef Kordac XU1NQ/OK1NQ.

REPUBLIC OF KOREA

Byong-Joo Cho HL5AP
Room 401 CO Building
157-7, Kwangan 2 Dong, Nam-Ku
Pusan 608-102
Republic of Korea

Hello to all. According to the official *Journal of the Korean Amateur Radio League*, a reciprocal license agreement has been made between the Japanese Foreign Minister and the Ambassador of Korea to Japan as of May 15, 1992. Further information will be provided as it becomes available.

Korean operators have been restricted from operating portable in the past, but as of August 1st we will be able to operate in automobiles and with handhelds with power limited to 50 watts maximum. The *KARL News* said that more information will be provided in the future.

We have also heard that OK1DTG operated from P5-land on 7 MHz CW on April 17, 1992, but we have been unable to confirm legal station license information. *[Reported in the August issue of 73 in this column in a letter from Josef Zabavik OK1DTG/P5.—Amie]*

Now for some personal news. I had hoped to operate from D73DX, special DX contest call of the KARL during the 1992 WW WPX Contest from Pusan Yachting Harbour, but I operated with my own callsign at my home. For those of you who contacted D73DX, you may QSL via HL5BUV, P.O. Box 12, Pusan 600-600, Korea; or via HL5BPF (*1992 Callbook* ok); or via the Bureau. They have printed up a special QSL card for this year's contest.

Best wishes to all from Korea.

SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S-155 34 Nykvam
Sweden

NEW NOVICE LICENSE Foreningen Sveriges Sandareamatorer, SSA, and the Swedish Telecommunication Authority, Telestyrelsen, have together worked on a program for recruiting new radio amateurs. The annual growth of the ham population In Sweden has been lower each year during the 1980s and the net growth has been close to zero for the last two years. The average age for the ham population has increased each year. It is difficult to attract young people to become hams. The lowest age limit for a ham license has been 14 years, which seems much too high. By that age, young people have tried a lot of hobbies and it is then very difficult to get them to try ham radio. Furthermore, they have to do a lot of studying and learning Morse code before they are allowed to start transmitting. Young people, although they leam quickly if they want to, do not always have that patience.

What should we do about this? The traditional activities we have done so far have been positive but not enough. We must catch the youngsters in the schools and already in the lower grades. We must get the teachers interested in bringing ham radio into the schools. With this goal in mind, SSA, the Swedish national amateur radio organization, said to Telestyrelsen that "we need a supporting contribution from you." The amateur radio section of Telestyrelsen has also been worried about the NIL growth and are very supportive. The result from the discussions on this subject came in June 1992.

A new license, the Novice license, has been implemented. The lowest age limit for this is 10 years, or, in fact, you can become a licensed ham "during the calendar year you turn 10 years of age." This gives us a totally new group of young people for our approach. This Novice license is a no-code license, gives privileges for two bands, 144 and 432 MHz, all modes. The maximum power limit is 25 watts PEP output and 100 watts ERP. The requirements for the license exam Is more towards operating practice than theoretical technical aspects. The fee for the Novice exam is lower than for other classes of license and if you upgrade before 15 years of age you pay a lower than regular fee for the upgrade. This is another contribution from Telestyrelsen in order to make the amateur radio license more attractive for young students.

Each licensee under 14 years of age must have a named person responsible for coaching and further education, an "elmer." We use that concept, well-known to most hams. A Novice licensee Is supposed to upgrade as soon as possible and the time limit for this license is six years and cannot be renewed. However, if you are under 14, you must have the Novice license two years before you can upgrade, which means that you can get a higher class license "the calendar year you tum 12."

Although the other classes of licenses are more or less unchanged, this Novice license is one part of the package. Before this addition, we had three classes of licenses for HF/VHF: Class A, B, and C. A fourth class, T for Technical, Is a no-code VHF license. The lower age limit for A (our highest class of license) is lowered from 17 to 15 years of age, C from 14 to 12, and T from 17 to 12 years of age.

The Telecommunication Authorities in Europe are trying to "harmonize" the requirements for one major license and one no-code VHF license, a so-called CEPT Class 1 and Class 2 license. The Idea is that if you move from one country to another, you do not have to pass a new exam in that country if you already have a "harmonized license" from your home country. Therefore, in Sweden, the code speed requirement for the Class A license has been lowered from 80 marks a minute (16 wpm) to the more common 60 speed (12 wpm). This change made the difference between Class A and B very little and Class B will be phased out by not issuing any new Class B licenses.

Now we are starting activities in schools and a possible success lies In our own hands. We radio amateurs must not any longer hide in our shacks in the basements. We are an aging population and we must get new blood into ham radio. SSA has produced a six-minute video with a "young touch." We are working on getting this video to be shown in all schools and there is a program for getting hold of those students showing Interest in knowing more about how to become a ham. We must do this ourselves if we want amateur radio to grow and prosper. If we do not, we probably will lose privileges and frequencies to other services.

Number 27 on your Feedback card

BARTER & BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

Deadline for the November classifieds is September 12, 1992.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. Affordable Electronic Repair, 710 East Thomas Rd., Scottsdale AZ 85251. (602) 945-3908. BNB220

FINALLY HEAR those unreadable signals buried in noise, heterodynes, tuner uppers. The **REVOLUTIONARY** new JPS audio filter NIR-10, digital signal processing, simple hook up, deep discounted $329.95 delivered! Authorized dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR. Orders: (800) 484-4002, code 1356. BNB254

THE MOST COMPLETE AND COMPREHENSIVE RESISTOR COLOR CODE IDENTIFICATION CHART/COIL WINDING DATA CHART/L, C, F NOMAGRAPH. Is your resister identification getting rusty? Don't waste time looking for that old basic electronics book. Have this handy chart posted above your work bench. Chart includes these hard to interpret 5-band precision resistors, includes all known tolerance colors too! Included with the resistor chart is a handy coil winding data chart for RF coil windings. For those who hate to do math calculations, if you know any two of your L, C, or F, you can find the other instantly with this handy L, C, F Nomagraph! Send $3.00 to **TMS ELECTRO DATA INC.,** 4906 S.E. Mills, Lawton OK 73501. BNB255

QRP KITS IN CANADA! CW Transceivers, Receivers, Communication Headsets, and more. Large SASE or Call: "CQ RADIO KITS." Box 1546, Bradford, Ontario. L3Z-2B8 CANADA. (416)-775-9119. BNB433

QSL CARDS- Look good with top quality printing. Choose standard designs or fully customized cards. Request free brochure, samples (stamps appreciated) from Chester QSLs, 310 Commercial, Dept. A, Emporia KS 66801. FAX (316) 342-4705. BNB434

REVOLUTIONARY HYBRID AERIAL WIRE: 168-strand copper "FLEX-WEAVE" Tm, #14, strong, Ultra Flexible, ties in knots, nonstretch, won't rust/kink like copper weld, $36.95 first 275' (minimum), $.13/ft. thereafter, includes shipping! (Radial wire only.) Catalog $1.00. DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB557

COAX, GROUND RADIAL WIRE, lowest cost, top quality, MilSpec RG-213, $.38/ft.; RG-8X, $.19; RG-58, $.18; LOW LOSS Belden equiv. RG-9913, $.39; any lengths plus shipping. Radial wire #16, $39.50/1000 ft. includes shipping! Immediate shipment. Catalog, $1.00. DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB562

WANTED: Six Meter Transceivers and Linear Amplifier. Am especially seeking Clegg Venus and Zeus. Must be excellent condition only. Leave message: Jim, 703-922-9789. BNB563

WANTED: ROBOT 1200C in excellent electrical condition. MUST HAVE SCOTTIE 3.6 EPROM. Call sign irrelevant (SWL use only). Simon 609-663-5362. BNB701

RIG REPAIR by 20-year ham. Fast, reasonable. Skip Withrow, 5404 S. Walden Street, Aurora CO 80015. (303) 693-0997.BNB702

IBM PC VIDEO DIGITIZER 640 BY 480 RESOLUTION. 256 gray levels, $89.98. Demo disk, $3. Information, $1. Colorburst, Box 3091, Nashua NH 03061. BNB703

ROSS' $$$$ NEW October (ONLY): KENWOOD TH-28A $330.00, TM-241A $354.90, TS-450SAT $1198.90, TS-711A $929.90, ICOM 2GAT $322.00, 229H $358.00, 735 $910.00, ALINCO EP-2010 $85.00, EBP-12NA $50.00, ALM-203T $209.99, BUTTERNUT HF6VX $140.00, RMK-II $54.50, YAESU FT-709R $289.99, FT-2400H $340.00, FT-470 $370.00. ALL LIMITED TIME OFFERS. LOOKING FOR SOMETHING NOT LISTED OR HARD TO FIND? CALL OR WRITE. Over 9,000 ham-related items in stock for Immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB707

BIG BOOK OF MODIFICATIONS Amateur, Scanners, and Receivers. Simple to Complex electronic and keyboard modifications. Send $20.00 US to Mike Poczynek, Fiesta Mall, Box 56074, Stoney Creek, Ontario, Canada, L8G 5C9. BNB711

PACKET MASTER 1.0 Now run Packet from Windows. Multitasking software makes Packet easy! Send $19.95 to The Mercury Group, 5901 Mercury Drive, Fort Collins CO 80525. BBS 5 p.m. - 8 a.m. 303-223-7280 voice 8 a.m. - 5 p.m. BNB709

GIANT SOLAR PANELS $44.00 EA! Excellent Prices/Solar Equipment/Accessories. Free Information/Send Stamped Envelope, Catalog $3.00. To: Pak Rat Electronics, P.O. Box 690073, Houston TX 77269. (713) 893-0313. BNB715

SIMPLEX REPEATERS $149.00! We manufacture them ourselves. Pak Rat Electronics. (713) 893-0313. BNB716

ELECTRON TUBES: All types and sizes. Transmitting, receiving, microwave . . . Large inventory = same day shipping. Daily Electronics, 10914 NE 39th ST. Suite B-6, Vancouver, WA 98682. (800) 346-6667 or (206) 896-8856. BNB719

WE HAVE IT! AEA, Astron, Bencher, Butternut, Callbook, Comet, Diamond, Hustler, Kantronics, Larsen Antennas, MFJ, Radio Shack, Smiley, antennas, Valor antennas, and more. Small town service with discount prices. Dandys, 120 N. Washington, Wellington KS 67152. (316) 326-6314. BNB722

MINIATURE POLICE RADAR TRANSMITTER one mile range, $41 assembled, $31.00 kit, (219) 489-1711. P.O. Box 80096, Fort Wayne IN 46898. BNB725

BUILD YOUR OWN WIRE ANTENNAS, parts, GROUND RADIAL WIRE, open-wire feedlines, copper-weld, Insulators, coax, Dacron rope, baluns, etc., LOWEST PRICES. Catalog, $1.00, DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB726

HAM RADIO REPAIR—Prompt service. ROBERT HALL ELECTRONICS, 1660 McKee Rd., Suite A, San Jose CA 95116. (408) 729-8200. BNB751

PICTURE QSL CARDS of your shack, etc., from your photo or black ink artwork. 500 $28.00, 1,000 $44.50. Also non-picture cards. Custom printed cards, send specifications for estimate. Send 2 Stamps for illustrated literature. Generous sample kit $2.00, half pound of samples $3.00. Raum's RD2, Orchard Road, Coopersburg PA 18036. BNB756

ALUMINUM MAST- 2" OD X .25" wall, type 6061-T6. 6' $39.95, 9' $59.95, UPS paid tower 48. Lengths to 24' in stock! Doug/WS9W, Box 384, Stoughton WI 53589. BNB757

RAMSEY AND ICOM-22S OWNERS: Conversion kits for full coverage, direct frequency entry, 5khz spacing. Send SASE for details to: TechnoLogic Concepts, 1803 Mission St., Suite 308, Santa Cruz CA 95060. BNB758

DO YOU SURVIVE? Can you contact the Spirit World with electronics? Instructions $10, Guaranteed, 18 Yrs. Experience. Bill Weisensale, Box B.Q. C6, Barstow CA 92312-3030. BNB759

AMATEUR RADIO SERVICE: Complete repair facility. 15 years communications repair experience. Special service needs? No problem. Give us a call. Compassionate rates. HAMSERV, 1720 Grand Ave., Waukegan IL 60085. (708) 336-2064 (Dean) or Voicemail at (708) 580-2034. BNB760

THERMOGRAPHED CARDS! Raised print QSLs at flat printing prices. Samples: Phone (817) 461-6443 or write: W5YI Group, Box 565101, Dallas TX 75356. BNB761

WANTED: HAM EQUIPMENT AND OTHER PROPERTY. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501 (C) (3) status by the IRS, incorporated with the goal of using the theme of Ham Radio to further and enhance the education of young people nationwide. Send your radio to school, your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Please look over whatever unwanted equipment you may have, and call us. We will pick up or arrange shipping. You will receive the tax deduction, but most important, the privilege of knowing that your gift really made a difference in the education and upbringing of a child. You are invited to check into the WB2JKJ "22 Crew" CLASSROOM NET, 7 AM EST on 7.238 MHz or on 21.395 throughout the day. We will be running a Special Event station, Oct. 21-23, celebrating our 12th year of operation. The kids operating will be just some of the children hoping for your support of EDUCOM. Write us at: The RC of JHS 22 NYC, INC., P.O. Box 1052, NEW YORK NY 10002. Round the clock HOTLINES: Voice (516) 674-4072, FAX (516) 674-9600. BNB762

ELIMINATE MULTIPLE NOISE TONES in your receiver audio output. The revolutionary new JPS notch filter, model #NF-60, Digital Signal Processing simple hook up. Unlike other Notch Filters, notches out multiple varying tones. **Deep Discounted:** $139.50 delivered continental U.S.! (Elsewhere $150.00 plus shipping.) Authorized JPS dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR orders: (800) 484-4002, code 1356. BNB763

SOLAR POWERED HAMS! The Sunswitch is a charge controller to protect your batteries from over charge. Power MOSFETs are used, no relays! Assembled tuned and tested $39.95 plus $2.50 shipping. Sunlight Energy Systems, 2225 Mayflower NW, Massillon OH 44647. BNB774

GET YOUR PL259 CONNECTORS TODAY! Only $.35 each sold in lots of 100. Order now!!! Call or Write Foss Warehouse, 289 Schenk Street, North Tonawanda NY 14120. (800) 488-0525. BNB810

MILITARY MONITORING ANTENNAS: broadband VHF/UHF discones, biconicals, satcom types, 30-1000mc. shipboard construction, 'N' connectors, satcom preamps, antenna multicouplers, cables, accessories. (419) 726-2249. bBNB813

FREE SHAREWARE AND HAM CATALOG for IBM or CoCo. Morse code computer interfaces, $49.95. Dynamic Electronics, Box 896, Hartselle AL 35640. 205-773-2758. BNB815

DIGITAL SWRandPOWER METER, Assemble, Kit, or Plans, with Alarm and Set Points.FREE Information. **RUPP ELECTRONICS,**5403 Westbreeze, Fort Wayne IN 46804. 219-432-3049. BNB831

R-390-A SERVICE: module repair to complete remanufacture, cosmetic restoration, 20 years experience, expert service, 1-week turnaround. Very reasonable, any condition accepted. (419) 726-2249. BNB834

FCC COMMERCIAL LICENSE PREPARATION RADIOTELEPHONE-RADIOTELEGRAPH. Latest home study fast easy audio video.
FREE details WPT Publications 1-800-800-7588. BNB840

PRINTED CIRCUIT BOARDS-etched, drilled, tin-plated. Single sided $1.25/sq. inch. No setup charge. Send negative or artwork ($10.00 for negative). We can generate artwork from your schematic. **CHELCO ELECTRONICS,** 61 Water St. Mayville NY 147571-800-388-8521. BNB842

INEXPENSIVE HAM RADIO EQUIPMENT. Send postage stamp for list. Jim Brady WA4DSO, 3037 Audrey Dr., Gastonia NC 28054. BNB890

FREE Ham BBS. 904-542-3028. BNB899

AMATEUR RADIO REPAIR!! All makes & models maximum labor per unit, $80.00. TELO (Dan), 1302 S. Uplands Dr., Camano Island WA 98292. (206) 387-3558. BNB900

Packet on the Mac

Continued from page 14

a BBS in Sunnyvale, California. The window name will be: AX25 - N0ARY-1, and the session in the window will be an AX.25 session.

Watching the World Go By

You can monitor all the packet activity on a channel, including the messages NET/Mac is trying to transmit, by invoking the trace command: **trace ax0 111**. A window will open, showing all transactions. If you shrink (re-size) and relocate this trace window and open another one (by connecting to your favorite BBS, for example), you can monitor all the packet activity on the channel in the trace window and see just the packets sent to you in the BBS's window.

Controlling RFI

You've all seen the warnings printed in the owners' manuals about radio and television interference. "The equipment described in this manual generates and uses radio-frequency energy . . . it may cause interference with radio . . . reception."

Personal computers have plenty of circuits in them, running square or sawtooth waves at up to multiple megahertz rates. The Macintosh is no exception. This environment is rich in harmonics and some of them are often in the 2 meter band. When a device is tested for compliance with the FCC part B limits, the test antenna is about a meter away from the unit under test. Right next to the computer the signal strength at some frequencies may be high enough to register S9 +60 on your HT. The more sensitive and less selective your radio is, and the closer the antenna to the computer, the greater the chance that there will be interference on a particular channel. When this happens, do like the manual says: move the antenna. You can also try adding ferrites or bypass capacitors to the data and audio I/O lines.

Unfortunately, portable computing generally means poor grounding, so the effectiveness of grounds and shields may also be reduced. On a base station, you should get very good results as long as you follow the normal precautions.

Now you Mac owners can get on packet just as easily and inexpensively as those "other" computer users. 73

Parts List

All parts, with the exception of the TCM3105 and the crystal should be readily available at your local electronics emporium.

Capacitors	
C1,C3	10 µF 10V electrolytic (2/4)
C2,C4,C7 C8,C10	0.1 µF mono radial (5)
C9	270 pF mono axial (1)
C5,C6	18 pF mono radial (2)
Resistors	
R1-R3	50k ohm trim pot (3)
R8	23k ohm 1/4 watt (4)
R9	4.7k ohm 1/4 watt (1)
R5	75 ohm 1/4 watt (2)
Transistors/ICs	
D3	LM385-Z2.5 (2)
Q1-Q3	2N2222 (3)
Y1	4.4336 MHz xtal (1)
	Midland-Ross MPC 18 (use 27 pF)
	CTS Knights R 1335-5BA4433619 (use 27 pF)
	Erie L 01-0096-004433618 (use 50 pF)
	Seiko no p.n. available (use 15 pF)
U1	TCM 3105 IC (1)
D1,D2, D4-D8	1N914 diode (6)
	16-pin DIP socket (1)

(Note: A 4.4340 MHz crystal and 18 pF caps have been used successfully.)

A complete kit of parts including the PC board is available for $30 from the author at Sigma Design Associates, Attn: Dexter Francis, 22150 Berkeley Court, Los Altos CA 94024.

An etched and drilled PC board is available for $3.50 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

To obtain a disk containing SoftKiss and NET/Mac, including the Hypercard stack, you can send a blank 3.5" diskette along with an SASE to the author. The author can also be reached at CompuServe: 70611,1340 or Internet at Francis4@Apple.com.

Number 28 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Last month, I told you a story of a radio club that was discriminating against new Technician class licensees. I requested letters from you, describing your good and bad experiences. The letters have been pouring in, so I thought I'd share some of them with you.

The overwhelming majority of letters received have been positive. I've heard from new Techs from all across the country, and with very few exceptions they are reporting that local individuals and clubs have welcomed them with open arms. It seems that the boneheads I referred to last month are the exception and not the rule. This is good news indeed.

Matt N1LTW—"As a 14-year-old no-code Technician, I was, and still am, enthusiastic about the hobby. I was impressed by the encouragement given by the VEs at the test site and by those I've met over the air. They were happy to hear a new person, but they didn't want me to stop there. As a result, a little more than four months later, I am now a Technician + Code with the general written exam under my belt. By the end of the year, I plan to be N1LTW/AA. Granted, it takes a lot of self-motivation, but the extra commendation and encouragement sure does help you reach your goals!" Matt goes on to recommend the Falmouth (Massachusetts) Amateur Radio Association as a "great club to belong to."

Don N1FDF—"There are a lot of clubs that go out of their way to welcome new licensees to their folds. One local club here even gives the first year's membership as a gift to newly licensed hams, regardless of license class."

Bill N8POV—"While there are a few rabid hams who refuse to speak with those of us who are codeless Technicians, most have welcomed us. For example, I am a control operator for one of the local repeater organizations. In addition, I'm the net control station for the Central Ohio Traffic Net, the Central Ohio Severe Weather Net and the Central Ohio ARES Net. I've been warmly welcomed at repeater club meetings, ARES events and weather net training sessions. Dozens of codeless Techs are involved in many of these same activities . . . Virtually without fail, more experienced hams have encouraged me to upgrade; but not so I'll become a "real ham"—they simply know I'll have fun working HF when I do upgrade."

Tom N3LWJ—The Antietem (Maryland) Radio Association "tries to have as many classes as possible to get new hams, code or no-code! The club encourages code training only as a means to enhance your enjoyment of radio, not to set you apart. Techs are welcomed, helped, advised, allowed to vote, hold office—in other words, what any member is entitled to do . . . On the air, if you have problems, someone always comes on to help—not to put you down."

It does my heart good to receive all of these positive responses to my inquiry. Unfortunately, I have also received a few letters like the following. I've omitted any references that might identify the writer.

"One of my first contacts on the XXXX repeater was when i asked for a signal check. The reply came back, 'No-code Tech?' I answered, 'Yes sir,' to which there was no response, no ID, no nothing. I then politely thanked the gentleman for his response, as it was enough to let me know that my radio worked fine.

"This world is filled with people of different colors, religions, cultures and abilities. Bigotry is alive and well and has found a new 'lower-class human' to attack: the dreaded no-code Technician.

"In my area, there are two linked repeaters that are monitored 24 hours a day by the XXXX Amateur Radio Society. They provide a link between hams on the highway and the highway patrol. I do not think that the dozen or so stranded motorists and accident victims whom I have called into the highway patrol would have looked down on me merely because I do not yet know Morse code . . . So far, only a few people would not say anything. Too bad. Each of us has something to offer, even if it is only a friendly ear or voice on the way home from work."

I have also received a few letters from hams who have been licensed for many years. The writers have brought up all of the same chestnuts that weren't true a year ago and still aren't true today. Two meters has *not* become like CB. Sure, every once in awhile a nervous newcomer lets a "10-4" slip through. So what! Didn't you make a few mistakes when you were first licensed? I know I did! Terms like "handle," "destinated," and an assortment of unnecessary Q-signals are heard on repeaters every day, and they were used long before the no-code license. With a little practice and the good example of other hams, any new licensee quickly gets the hang of it.

Neither has 2 meters become a crowded cacophony. I travel all over the country, and 2 meters seems about as populated as before. Since it's hard to find a populated area without access to at least a dozen repeaters, this is not surprising. People seem to congregate on one or two repeaters, and the rest remain silent.

The only thing that has happened is that amateur radio has received a much needed shot in the arm. We have attracted several thousand new members who are turning out to be an asset to our numbers. New Techs are running nets, helping with emergency communications, and doing the hundreds of other things that hams do. There's one other thing the new Techs are doing that I hope all you buzzards who thought no-code was the end of the world will take note of. New Techs are upgrading at a phenomenal rate. Every single letter I received, and every Technician I've met in the past year, have all mentioned that they have upgraded or are studying to upgrade. They're learning new things, having fun and becoming an asset to our hobby through their work and enthusiasm. I wish I could say the same about all hams.

I was glad to discover that discrimination against Techs is not as widespread as I feared. I promise you, this is the absolute last time we will address this subject within these pages. The case is closed (maybe). 73

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Although October is considered one of the better months of the year for DX and good HF propagation, this year is likely to be slightly different. I expect fewer "Good" days and more "Fair" or "Fair to Poor" days this year. One reason is the rapidly declining sunspot cycle and low solar flux values, together with days of predicted upsets in the earth's magnetic field. As I write this column, solar flux values have, for the second time this year, dropped to 100 or below, and I expect to see this trend continue into the fall months.

To improve your chances of carrying on worldwide contacts, use the charts as follows: First, decide where in the world you wish to communicate and then find the band and time where conditions are likely to favor propagation to that location. Next, use the daily forecast to select the day or days with "G," that is, "Good," conditions forecast. Finally, monitor WWV at 18 minutes after any hour for the latest update in solar flux and magnetic field conditions. Remember that *high* flux values, say 150 or over, and *low* Boulder "A" and "K" indexes will represent the best conditions. "A" index values below 10 and "K" index values of 2 or below will most likely represent your best opportunities when combined with the information mentioned above. The WORST days will be the 5th and 6th, the 17th through 20th, and around the 9th and again on the 30th and 31st. Examine the chart carefully. In general, set your clock to GMT or UTC (we used to call it Greenwich Mean Time, but it's now called Universal Coordinated Time) and it's the same setting as before. Our data is given in UTC or GMT, so don't make the mistake of trying to use local time for your band-time-direction study.

In October the noise levels are lower than during the summer and you can take advantage of seasonal improvements in nearly equal hours of daylight and darkness. The "Top Band"—160 meters—will begin to exhibit excellent opportunities much earlier in the evening and continuing throughout the "wee" hours of the night and early morning. The same will be true of 80, 40 and 30 meters. The higher bands from 20 meters up will close earlier, usually shortly after sundown—with only 20 showing any real openings into the late evening, and then only on some days. Ten meters will not be particularly good with declining MUFs, but satellite operators will continue to enjoy their contacts. REMEMBER THERE ARE ALWAYS EXCEPTIONS TO THESE GENERALITIES, SO NEVER BECOME DISCOURAGED. One good day makes up for many bad ones. Good luck, happy DXing and look for us next month. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15*	20	20	20	—	—	—	—	—	—	—	15*
ARGENTINA	15	15	20	20	40	—	—	10	—	—	10	10
AUSTRALIA	10	15	20	20	—	40	20	20	—	—	—	10
CANAL ZONE	15	40*	40*	40*	40*	—	20	10	10	10	10	10
ENGLAND	20	40	40	40	—	—	20	10	10	10	15	20
HAWAII	10	15	20	20	40*	40	20	20	—	—	—	10
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	15*	20	20	20	—	—	—	—	—	—	—	15*
MEXICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
PHILIPPINES	—	—	20	20	—	—	20	15*	15*	—	—	—
PUERTO RICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
SOUTH AFRICA	40*	20	20	20	—	—	—	—	10	10	10	15
U.S.S.R.	—	40	20	20	20	—	—	10	10	15	20	20
WEST COAST	10	15	20	20	80/40	80/40	—	—	—	10	10	10

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	20	20	—	—	—	—	—	—	—
ARGENTINA	15	15	20	20	20	—	—	10	—	—	10	10
AUSTRALIA	10	15	15	20	20	40*	40	20	—	—	15	10
CANAL ZONE	15	15	20	20	—	40	40	10	10	10	10	10
ENGLAND	—	—	—	—	—	—	10	10	15	15	20	20
HAWAII	15	15	20	20	40*	40*	40	20	—	—	10	10
INDIA	—	20	—	—	—	—	—	20*	15	—	—	—
JAPAN	10	15	20	20	20	—	—	—	—	—	—	—
MEXICO	15	15	20	20	—	40	40	10	10	10	10	10
PHILIPPINES	15	—	—	—	—	—	—	20	10	10	—	—
PUERTO RICO	15	15	20	20	—	40	40	10	10	10	10	10
SOUTH AFRICA	20	20	20	—	—	—	—	—	10	10	15*	15
U.S.S.R.	—	—	20	—	—	—	20	15	15	15	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15*	—	20	20	20	20	20	20	20	—	15
ARGENTINA	10	15	15	20	20	20	—	—	10	—	10	10
AUSTRALIA	10	15*	15*	20*	20	20	40	—	—	—	—	10
CANAL ZONE	10	15	15	40/30	40/30	—	—	—	15*	10	10	10
ENGLAND	—	—	—	—	—	—	—	—	15	20	15	—
HAWAII	10	10	15	20	40*	40*	40	40	15	15	—	15
INDIA	—	[illegible]	—	—	—	—	—	—	[illegible]	15*	—	—
JAPAN	10	15*	—	20	20	20	20	20	20	20	—	15
MEXICO	10	15	15	40/30	40/30	—	—	—	15*	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	—	20*	15	15	—
PUERTO RICO	10	15	15	40/30	40/30	—	—	—	15*	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	—	—	—	20	20	—	—	—	15	15	20	20
EAST COAST	10	15	20	20	80/40	80/40	—	—	—	10	10	10

* Try next higher band (1) Difficult path

October 1992

SUN	MON	TUE	WED	THU	FRI	SAT
				1 F	2 F-G	3 G
4 G-F	5 F-P	6 P	7 P-F	8 F-G	9 F-P	10 P
11 P	12 P-F	13 F-G	14 G-F	15 F	16 F-P	17 P
18 P	19 P	20 P-F	21 F	22 F-G	23 G	24 G-F
25 F	26 F-G	27 G	28 G-F	29 F-P	30 F-P	31 P

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NOVEMBER 1992
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73 Amateur Radio Today

November 1992
Issue #386

TABLE OF CONTENTS

FEATURES

REVIEWS

Stephen Glowacki KC4TMT shows you how to build your own HF mobile antenna . . . see page 18.

Cover: JaMi Smith KK6CU with his mobile foxhunt array. It rotates continuously at 40 rpm and displays bearings on a storage oscilloscope. Find out more in this month's "Homing In." column on page 34. Cover photo by Joe Moell KØOV.

DEPARTMENTS

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

CW In 1992

A reader noted this response when he asked about the code in the military: "We don't train radiomen to copy code any more. Why would we want to train someone to copy code when we can move messages at 1,500 words per minute encrypted, download it, decrypt it, have it letter perfect and hand deliver it to the addressee? The Navy can't live with 35 wpm response times. Heck, even our tugs have high speed communications."

Sure, manual CW is fun. But it's like the fun men have driving antique cars and preserving them. Should our motor vehicle departments insist that people prove their ability to crank a Model T and drive a stick-shift in order to get a driver's license to operate today's automatic shift cars? It makes the same kind of sense.

Making a Buck

The endless whining letters from retired old-timers who are trying to make do on Social Security make me sick. The world is out there with 10-dollar bills hanging from the branches of almost every tree and these old geezers are too lazy to bother to reach up and pick 'em. Then there are the millions of people who are "out of work" and can't find a job. If you can't find a job, make one!

A chap stopped by to visit the other day. Out of work. What can he do? Well, here we are in a recession. Here we are in what looks like it's going to be a very long recession because the factors that caused it haven't been addressed by the administration or Congress yet—nor is there any ray of hope on the horizon that they'll really do anything about it. Well, one man's catastrophe is another's bonanza. When Humpty falls you get busy and make omelets, you don't stand there wringing your hands while hydrogen sulfide develops.

Where are the opportunities for starting small businesses? Everywhere! For instance, with people losing their jobs right and left, many are also losing their homes. This presents a couple opportunities. One is to start making very low income housing for people who suddenly have to live on welfare or unemployment. But my approach as an entrepreneur would be to form a building maintenance service and offer it to the banks. For a reasonable price I'd look after their repossessed houses, keeping the lawns mowed and watered, the bushes trimmed, the windows repaired, the insides clean and dusted. The house isn't going to sell if it looks ratty. I'll bet I could sign up the banks around southern New Hampshire to let me handle at least a couple hundred homes. Heck, there are several just on my little country road that have "For Sale" signs on them and are unoccupied. They all need attention.

Then there are families going on vacation. They need their homes checked, animals fed, and the junk mail taken in. All you need is to be reasonable, dependable and known to your potential customers. To be known you have to have some visibility and that means small ads in the paper, an occasional news item, perhaps a TV interview, if you can organize it. It means mailing cards to the owners of better homes. It means visits to the local banks—and more visits.

Any problem offers opportunities—it's all in how you think about it. My wife Sherry noticed how difficult it was to find good baby-sitters. So she started a baby-sitting service. She interviewed potential baby-sitters and checked their references. She ran ads and checked with the customers to see how well her sitters were doing. She helped train them. The first thing you know she had dozens of sitters and a land-office business going, with her getting a commission on every job. And that was before computers, which would make it even easier to keep track, do the billing of the customers and handle the payroll for all those independent contractor sitters.

So what services are needed in your area? I can think of a bunch more, but let's get your little gray cells perking instead of sitting there in a loop.

Fixing The Brain

It all started with an article in *Analog*. When I was young I read a lot of science fiction. The best was in *Astounding Stories*, edited by John Campbell W2ZGU. The magazine is now *Analog*.

John had an enormous influence on me. He was the first magazine editor I'd ever seen who wrote long editorials about whatever was interesting him at the time. How many magazines have you seen with interesting editorials? It's rare. I eventually got to be good friends with John. We'd get together for lunch every few weeks. Talking with him was exciting—like a mental roller coaster, with ideas on nuclear physics, cosmology, quantum physics and so on going by in rapid succession. He was interested in everything and never restrained by scientific or religious dogma. Alas, he smoked, so he died far too young.

So here I am, still an *Analog* subscriber after 58 years and still turning to their science fact article the first thing every month. They're usually outstanding.

The article they published on how the brain worked made so much sense that I bought the book on the subject. I had to know more. Since I approach all new ideas as a skeptic, I wanted to give this new concept a try and see if it really worked. The idea that painful incidents happening to a baby before it's born could influence it all through life was rejected flat out by doctors and psychiatrists, yet from a systems analysis view, it made perfect sense.

I was a radio announcer at WSPB, a radio station in Sarasota, Florida, at the time. I talked over the idea with a fellow announcer. He was skeptical, but game for us to give it a try and see what would happen. We decided to see if we could find out why he had to cough every time he was starting to announce. He'd solved the problem by installing a small switch by the microphone which would cut it off while he coughed.

So I put him into a light hypnotic state and asked him to repeat the word cough. I then asked him to go to the earliest time he had to cough and to say whatever came to mind. He said, "I've got to cough." I asked him to keep repeating that and see what else came to mind. This developed into, "Every time I get nervous I have to cough."

For about an hour I kept getting him to come up with more words and phrases. I asked him his age and he said eight. I asked if that was years. He said no, it was months. I said before or after birth. He said it was before birth. Hmmm. Sure. Well, it it might help, what's the difference, so we continued. I wrote down the stuff he was saying. The story that emerged was of his mother and father living in the back of a cold, damp factory building. His mother had a bad cough, which apparently was painful to little pre-Joe. The father said something about her staying with the family next door, the Murphys, until she felt better.

Whether this was all fantasy or reality I didn't know, but it was intriguing. Once we'd run through all this stuff a few times Joe never again had to cough when he was announcing. Something worked.

A few weeks later Joe's mother visited for a few days. I took her out to lunch, armed with my notebook. I asked her if she'd ever lived in the back of a factory. She was incredulous. Yes, not long before Joe was born. Was she sick at the time? She thought for a moment and then said she'd had a terrible cough. As far as she could remember this experience had never been mentioned after Joe was born. She'd forgotten about he whole thing until I reminded her. Then I asked if she'd stayed with some friends next door for a while. Yes! And did she remember their name? Was it Murphy? Yes, it was, and she was sure she'd never even thought of them since Joe was born.

This did a lot to convince me that this was a real experience that Joe was bringing up under hypnosis. Of course, there's always the possibility that he might somewhere have heard about all this and forgotten it, but that's a remote possibility since you don't forget things under hypnosis. It's all there.

Being a pragmatist I wasn't quite as interested in whether these were real memories or fake, as long as dredging them up and "running" them would erase the patterns causing problems in present time. I felt I had hold of something important, so I wanted to know more.

The radio station owner was impressed with my announcing and ability to ad lib morning shows. He offered to let me have a three-hour morning spot and share in the ad sales it would generate. This was an opportunity that many disk jockeys would kill for, but while I enjoyed the work, I couldn't see myself devoting my life to being a DJ. I quit to learn more about how to help repair minds. I moved to New Jersey and a research foundation. This turned out to be the wisest decision of my entire life.

In a few weeks of concentrated work I learned how to find and remove the causes of people's problems. Doctors today agree that all diseases have emotional components. What we discovered was how to find these and remove the basic causes for most illnesses. We even discovered that an amazingly high percentage of what seem like accidents have emotional causes.

My experience with Joe was repeated endlessly with other people I worked with. I've been promising my-

Continued on page 74

LETTERS

Number 2 on your Feedback card

From The Hamshack

David Rosner VE4DAR, Winnipeg, Manitoba, Canada I am a relatively new Canadian radio amateur, having received my Basic Qualification (no-code) in February 1992. Since getting on the air on the 2 meter band, I have tried to learn more theory and practice through discussion with more experienced hams and by reading *73* and other publications.

I enjoy your provocative editorials and remember your call for one million new hams and suggestions for learning CW. I was delighted, therefore, to win subscriptions to *73* and *Radio Fun* at my first hamfest last weekend at the Canada/U.S.A. Peace Gardens.

Please keep us thinking!

Larry J. Clark N2MOS, Princeton NJ Isn't it about time that amateur radio operators started paying their own way around here? We're facing a steadily escalating federal budget deficit, and we expect the taxpayers to pay for our hobby. Let's get real!

Free Lunch Nothing is free. If you want it, pay for it. We haven't paid a lick for what we use, but there are plenty of other people who would like more chunks of "our" spectrum . . . And they are willing to put up cash! If you want to use a National Park, you pay. You license your boat and you pay. If we don't pay for it, how can we claim it?

Public Service? This notion of all hams just waiting in ranks to put their radios into public service might just contain a measurable amount of bunk. What is the percentage of hams who really participate in meaningful drills and exercises? Most hams spend most of their time doing other radio stuff, some of it rewarding, some of it merely interesting, and (by an increasingly vocal minority) some of it downright destructive to the hobby (20 meters?).

Policing We've got a few Bozos out there. Unfortunately, they take up more than their fair share of domestic and international resources (radio frequencies). What if we decide to redefine the term "self-policing" as meaning the willingness to pay for competent enforcement by a properly staffed, equipped and trained FCC?

I believe that we should pay a fee upon initial licensing, upgrading and renewal. The fee should be sufficient to cover administrative costs during the period of the license, as well as the cost for a reasonable amount of enforcement in the amateur bands. The one exception to fees should be initial (but not renewal) for Novice class licenses. However, I think that a substantial discount for those under 18, the disabled and senior citizens would be in order . . . which, of course, would proportionately raise the fees of non-discounted hams, since we want the hobby to be pretty much self-funded.

The period between renewals will have to be determined, but somewhere in the neighborhood of every two to five years will probably work out. Annual renewal would be an unacceptable administrative burden, while too long a period wouldn't have the purging effect we need. Purging would end any bogus license counting that might be going on, and also give the manufacturers (and publishers) a more accurate estimate of what the hobby needs. I don't feel like actually shoveling gold into the pockets of the manufacturers, but I would like them to stay in business so I can buy stuff and get it fixed.

We might even consider basing the license fee on the amount of spectrum a license is authorized to use. The fair market value of VHF and UHF would probably be higher than HF, since it has more competitive commercial value and isn't as limited by international agreements and treaties.

Partial and/or full relief from fees could be provided by allowing credit to hams who participate in bona fide drills and exercises conducted by federally recognized (perhaps by FEMA?) public service agencies and organizations. This would have to amount to something more than the monthly check-in on the 2 meter net. By maintaining a data base of hams applying for fee credits, we could finally show exactly how many hams really are willing to support emergency service operations . . Of course, we have to be prepared for an underwhelming response as well.

A rational license fee would show that we pay our own way, are willing to pony up the bucks to support the FCC's enforcement efforts in our bands, support new and disabled hams, and offer that trained and equipped resource for emergency operations we've always talked about.

There is another advantage for those of us in the hobby coming up with a license fee scheme: If we don't do it, and soon, someone else (perhaps Congress) is going to ram it down our throats. Trust me . . . when these things come off the Hill they usually don't work right. The money would probably go into the general fund instead of to the FCC (perhaps an FCC Amateur Radio Trust Fund needs to be established). Congress's idea of a fee schedule could be pretty strange. And it would probably take us years to get Congress to fix things.

I think it is time to pay up.

J. G. Owen, Fort Salonga NY Greetings. I couldn't let that churlish fellow's complaint in the February 1992 issue stand unanswered. *I* like your editorials. Indeed, I have very little to do with ham radio, so probably the only reason I occasionally buy the magazine is for the editorials.

On another topic, from my non-ham viewpoint, the arguments about spectrum usage are very convincing; why *should* we give you guys all this stuff? I mean, if you want to talk to each other, can't you just use a car phone? I don't want to be harsh, but as you've pointed out again and again, hams have to appreciate how the rest of us are going to see this issue, and although I've hardly studied the thing all that much, I haven't heard any very convincing arguments on the hams' side.

Finally, one of the great things about your editorials is the broadsides you level from time to time at various offenders. It wouldn't hurt if you would occasionally go into background so we non-communicants might get the drift. For instance, I found your story in the February editorial about the various early leaders of the ARRL of considerable interest; on the other hand, I've heard a good deal about K1MAN and his nefarious activities, but never what must be obvious background (to hams) about exactly what it is he does. It's true, mostly hams read the magazine, of course, but good journalists (storytellers) should always try to be complete so none of us slower listeners get lost.

Dean Bergmann KB5UVT, Arlington TX Concerning David Cassidy's "Eventually, Morse code will be dropped from all license classes." ("Random Output," September 1992): Since international agreements are involved, it may be a long time before that is true. I suspect that in many parts of the world it is still important that CW rigs cost less; that they are simple enough for an amateur to build; that they use less bandwidth; and that they consume less power. As a newly licensed amateur, I am impressed by QRP CW rigs that can work the world with batteries that would only power a handie-talkie in other modes.

Cassidy is right about one thing: Innovation is vital. Amateur radio once led, and commerce followed. Now the reverse is true. Don't dream of copying commercial modes; dream of entirely new ones.

Dean—CW is, and always will be, a fun way to communicate. The gear is inexpensive, portable and simple to work on. The fact still remains that it is an inefficient way to transmit information and is quickly becoming a "nostalgia mode" like AM. My prediction is that the ITU treaty will drop this requirement someday—the sooner, the better . . . David N1GPH

Edwin S. Oxner, San Jose CA Wayne, you hit the nail squarely on its head—again ("Never Say Die," August 1992). Both our educational system and our prison system are a lost cause. And, none of our politicians are aware of either the problem or the cure.

As I read your column I was hoping to see comments regarding the burgeoning interest in home schooling that many families are adopting. My daughter has four youngsters receiving their education at home. It works, too. A year ago the Montana legislature planned to outlaw home schooling, but through the insistence of my daughter, who was privileged to speak to the joint houses of the Montana State Legislature, home schooling not only remained legal but was encouraged!

Another topic you covered related to corporations going "off-shore" to manufacture, thus depriving millions of Americans of their jobs. A principal cause of this exodus stems from the cross purposes between government agencies, namely the EPA under the guidance of Director Reilly. Why should our factories be forced to align themselves with the machinations of the environmentalists when foreign nations offer tax breaks, low interest loans and low-cost labor enticements? Again, do politicians understand? Obviously not. The EPA is an independent government agency within the Executive Branch, yet Bush still scratches his head wondering why joblessness remains high. Hey Bush: Look in your own back yard! (Remember, Wayne, Reagan dismantled the EPA; it was Bush himself who restored it.)

I appreciate your obvious concern for the welfare of this country; I trust you're concentrating your efforts where they'll do the most good.

Ray J. Howes G4OWY, Weymouth, Dorset, England Wayne, just thought I would drop you a short note regarding your editorial in the August '92 issue.

Suffice it to say that I agree with your incisive hypothesis; as usual it was right on the button. Yes, the British education system sucks, and as you infer it parallels what is apparently happening in America.

You won't be surprised to learn that I have written numerous letters to all those who possess governmental power, but not only that, I have actually spoken to these people in an attempt to dissuade them from their almost maniacal desire to preserve the status quo that unfortunately exists within our educational system. Trying to get these so-called elected "leaders" to see the error of their ways is akin to resurrecting the dead.

Perhaps I should mention the stranglehold the teachers union (N.U.T., quite an appropriate acronym) has on the teaching profession here in the U.K. The union bosses appear to be more interested in preserving their perks and large salaries than in eradicating the cancer that pervades their members' flawed "teaching" methodology. What a jungle.

As there are several teachers who are also hams in my immediate area, I've been expounding the virtues of re-inventing the wheel, so far as teaching is concerned, over my local repeaters, etc. Guess what? For my pains, all I hear from these supposedly "intelligent people" are pathetic excuses and irrational diatribes, instead of reasoned argument or constructive remedies. It's a monster out of control.

Hey, perhaps we need a Rupert Murdoch to do what he did to the British print unions, which were nothing more than constipated dinosaurs awaiting extinction. Murdoch went through them like a dose of salts. You would not believe the salaries "printers" were earning before Murdoch cut off the gravy train.

Don't lose heart Wayne, I'm doing my level best here in the U.K. to persuade those people who matter that education just has to undergo a transformation . . . now.

QRX . . .

Number 3 on your Feedback card

SAREX Flies Again on STS-47

The **space shuttle *Endeavour*** lifted off on September 12 at 14:22:59.974 UTC carrying two ham astronauts (Mission Specialist Dr. Jay Apt N5QWL and Payload Specialist Dr. Mamoru Mohri 7L2NJY) among its seven-member crew. This was the first on-time liftoff since 1985.

Due to the sleep and work schedule of the astronauts, most voice contacts took place over the Eastern hemisphere. Hams in the U.S. and Europe did have ample opportunity to work the shuttle via packet radio. The shuttle's packet callsign was W5RRR-1. This mission's high inclination orbit (57 degrees) put it within reach of those living in the higher latitudes.

Several schools in Australia and the U.S. were contacted directly by the shuttle and over 8000 packet and voice contacts were made during the mission.

A QSL is available if you've worked the shuttle or if you have a reception report. If you made a packet contact with the shuttle, please include your QSO number. Send a SASE (foreign stations should include at least $0 50 postage or equivalent IRCs) to Jay Apt N5QWL at 806 Shorewood Drive, Seabrook TX 77586 USA.

Earthwinds Update

The Earthwinds around-the-world manned balloon flight is now scheduled to fly any time alter November 15th. Inclement weather and wind patterns prevented last year's attempt from Akron, Ohio.

This time the launch point has been moved to Stead Field near Reno, Nevada. This area near Reno has some of the most favorable wintertime ground wind conditions in the U.S. and will give the launch team more opportunities for a successful liftoff of the complicated dual-balloon system.

The amateur radio experiment will operate during the mission under pilot Larry Newman's callsign KB7JGM. Twice each hour (at 30 and 55 minutes past each hour) a digitized voice message will give the balloon's latitude, longitude and ground speed on a frequency of 28.303 MHz. Transmissions at 15 and 45 minutes past the hour are also possible. This should give anyone with modest receive capabilities the opportunity to track the balloon's progress as it flies non-stop around the world. The expected flight path should carry the balloon from Reno to Texas, the Midwest and the East Coast during the initial portion of its journey. Launch updates will be posted on the Balloon section of the *73 BBS* at (603) 924-9343.

ARRL Kills Automatic HF Packet Forwarding

At the July board meeting of the ARRL directors it was decided to accept the Digital Committee's recommendation that unattended (automatic) HF packet forwarding should not be allowed. Currently a selected number of stations automatically forward packet messages on the HF bands by permission of a STA (special temporary authority). The current STA expires at the end of the year and will essentially kill the HF packet forwarding network. This network has been in place for a number of years and successfully transfers many thousands of messages each month between packet operators and BBSs across the country and around the world. The League's recommendation is for *semi*-automatic forwarding. This means that only a station with a control operator present may initiate a contact with an unattended HF packet station.

Lyle Johnson WA7GXD has come up with an intriguing proposal in the July '92 issue of TAPR's *Packet Status Register* that would move unattended automatic HF packet operations to segments in the WARC bands (30, 17 and 24 meters) to alleviate crowding on the popular 20 and 40 meter segments currently used.

It's hoped that a reasonable compromise or alternative can come about to keep the forwarding network alive. Write to your ARRL Director with your opinion on these proposals or suggestions for a workable unattended HF packet forwarding system.

Founder of Hallicrafters Dies

William J. Halligan W9AC, founder and retired chairman of the Hallicrafters Company, died July 14 at age 93 in Miami Beach. The man who started the firm in 1933 as a supplier of amateur radio shortwave receivers, and then developed it into a major manufacturer of electronic equipment for the home, industry, the military and aerospace, resided in Bal Harbour, Florida, and formerly in Chicago, Illinois.

Halligan, a native of Boston, Massachusetts, received a radio experimenter's license while still in high school, and held the amateur radio call letters W9AC. He worked as a wireless operator on excursion ships between Boston and other coastal cities, serving in WWI as a radio operator on the battleship *Illinois*.

Halligan attended West Point, but quit the military academy to instead become a newspaper reporter in Boston, and then later in New York. He left journalism to become the sales manager for a radio supply company in Boston, then started Hallicrafters in 1933.

During WWII, Hallicrafters made shortwave radios for the military. After the war ended, the company took to production of home television receivers and peacetime radar. In the early 1960s, the company's military contracts constituted 70% of its revenues. Hallicrafters helped to develop the Air Force Quick Reaction Capability (QRC) program, and then moved into space communications.

A 1953 *Chicago Tribune* article said of Mr. Halligan that due to his prominence in the industry, he was sometimes referred to as "Wireless Willie," or "Radio's #1 Ham."

Halligan, who served as President and CEO of Hallicrafters, continued in that position even after the company was acquired by Northrop in the 1960s. He retired in 1967, and is survived by two sons, William Jr. and Jack, 10 grandchildren and 12 great-grandchildren. *TNX Chicago Tribune; W9JUV; Westlink Report #631, August 14, 1992.*

"Wayne Green's World"

Wayne Green W2NSD/1 is the latest addition to the growing list of ham radio celebrities taking to the airwaves with a radio show of his own. "Wayne Green's World" was kicked off on Thursday, August 6th, as a part of the new lineup on the revamped Let's Talk Radio Network. In his first outing, Green touched on several subjects that included national politics, the welfare system, educational travel and cooking, as well as amateur radio. According to LTRN Producer/Director Frank Collins N6TAF, the response to Green's new program was overwhelming. Collins says that he received numerous calls after the program to congratulate the organization on bringing W2NSD to the satellite radio network. "Wayne Green's World" can be heard every Thursday at 9:00 p.m. Eastern time over LTRN on GTE Spacenet III, Channel 21, 6.2 MHz audio. *TNX Westlink Report, #632, August 28, 1992.*

Instant Licenses for Aliens?

The FCC on August 6th issued a Notice of Proposed Rule Making in P.R. Docket 92-167 to provide a way in which foreign amateurs could secure 60-day operating permission while visiting the U.S. The plan would include amateurs from countries with which the United States has no reciprocal operating agreement and would have volunteer examiners handle the mechanics of the applications. The comment deadline for P.R. Docket 92-167 is October 26.

The FCC proposes to have VEs examine the foreign operator's amateur license and identification, and determine the applicant's home operating privileges, then administer a 20-question examination "on those aspects of our rules that are most applicable to the type of operation in which the visitor plans to engage while in the United States."

The FCC suggests that VEs could compile the 20-question examinations from existing question pools maintained by Volunteer Examiner Coordinators.

Upon passing the examination, the foreign applicant would receive a Certificate ol Successful Completion of Examination, which would serve as proof of the foreign operator's conditional license authorizing operation in the United States, according to the FCC.

The volunteer examiners then would notify their coordinating VEC, who would add the pertinent information on the foreign applicant to a data base that is maintained and forwarded to the FCC on a regular basis. The foreign operator would be allowed one maximum 60-day operating period in the U.S. at any time within 365 days of the issuance of the CSCE. *TNX Westlink Report, #632, August 28, 1992.*

Number 4 on your Feedback card

The QRP 80/40 CW Sender

QRP power and QRP cost.

by Richard Q. Marris G2BZQ

My original plan was to home-brew a simple CW transmitter for a daily, early morning, point-to-point QSO with a friend in Germany, using 3665 kHz. This was a distance of 400 miles or so. I figured that around 5 watts CW would suffice, and decided to use semi-conductors. A look at some recently published designs indicated that this would involve a printed circuit, several semi-conductors, maybe 50 or more components, plus all the components for an AC power supply.

I went back to the happy days when I, and many others, used a single 6L6 or 6V6 transmitter and worked the world. With these happy recollections in mind, things really got out of hand—one thing led to another, and the QRP 80/40 was born.

This transmitter is a personification of simplicity in circuitry, simplicity in construction, QRP in power, and QRP in cost. It covers both the 80 and 40 meter bands, and is built into an existing metal cabinet measuring about 8.6" wide x 4" high x 4.1" deep (that includes the built-in AC power supply). It uses just one tube and can be loaded to 5 watts or so. In fact, the result is less complex than so-called "simple" semi-conductor jobs. The reliable, robust 6BW6 tube can be quickly changed and the design does not require a printed circuit—all major components have solder tag connections and the smaller components can be slung between them. By all means, toil away on a printed circuit board if it will make you happy, but I have always believed that "the simplest is the bestest." In addition, 85% of the bits and pieces were in my junk box.

The circuit in Figure 1 shows a relatively conventional circuit using a 6BW6 tube (V1), crystal-controlled with a pi-output circuit which is tunable over both 80 and 40, by simply plugging in an FT-243 crystal (either 80 or 40 meter band) for the selected band. Do not try to double an 80 meter crystal to the 40 meter band. The purpose of Cl (3–33 pF trimmer) is to pre-set adjust for a clean CW note, which can be a problem with a single tube TX. The power of the TX could be increased by decreasing the value of R3, at the risk of a T7/T8 note.

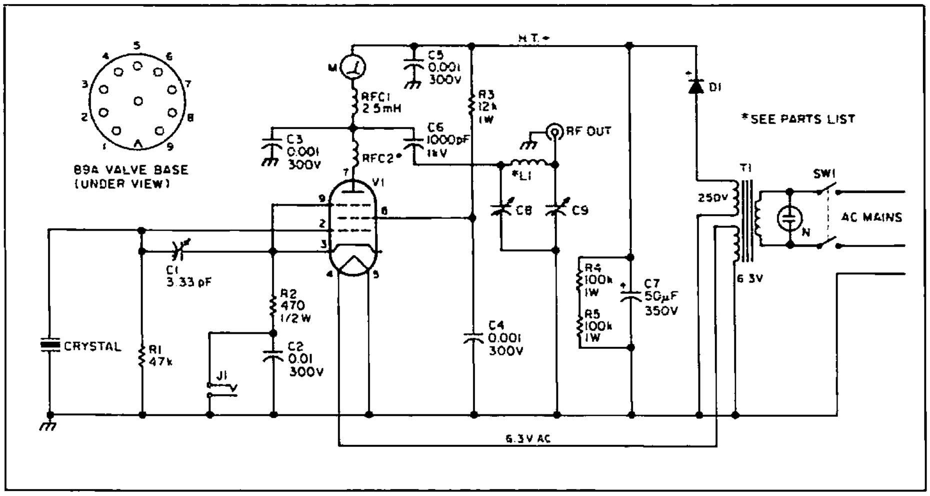

Figure 1. Schematic of the QRP 80/40 CW transmitter.

C8 is a single-gang 365 pF air-spaced good quality receiving type variable capacitor. C9 is a similar 2-gang 365 + 365 pF variable capacitor with both sections wired in parallel to give 730 pF total capacity. Both an external LC and "T" type ATU have been used with success and no detectable harmonics.

The built-in AC power supply half-wave rectifier used was an old Westinghouse 18RA which was in the junk box, but Radio Shack/Tandy and others stock suitable low cost alternatives.

The whole TX + AC power supply is enclosed in an existing metal cabinet 8.6" wide x 4" high x 4.1" deep, onto which a new front panel was fitted. A simple ┌─┐ shape chassis was made and fitted to the panel as shown in Figure 2, which also shows the assembled layout of the main components on the front panel and chassis. The size of the cabinet/chassis is not critical and the positioning of the major components can be adjusted slightly to accommodate the actual component sizes used by individual constructors. The HT DC plate voltage with "key down" was 115 volts DC.

L1 is wound on a length of 1" diameter PVC or plastic tube using 35 turns of 24-gauge enamel copper wire spaced one turn. The L1/C8 + C9 circuit should tune to the 40 meter band near minimum capacity. However, individual coils and layouts may differ slightly. If necessary, a small number of turns can be removed from L1 to achieve 40 meters with the C8 plates about 15% enmeshed, and then the 80 meter band should resonate with C8 plates about 65% enmeshed.

To test the TX, adjust C1 and C9 to maximum capacity and plug in a 50-ohm dummy load. Next, insert an 80 meter band crystal, press the key, and tune C8 for minimum current on the meter; then increase the current by detuning to give a

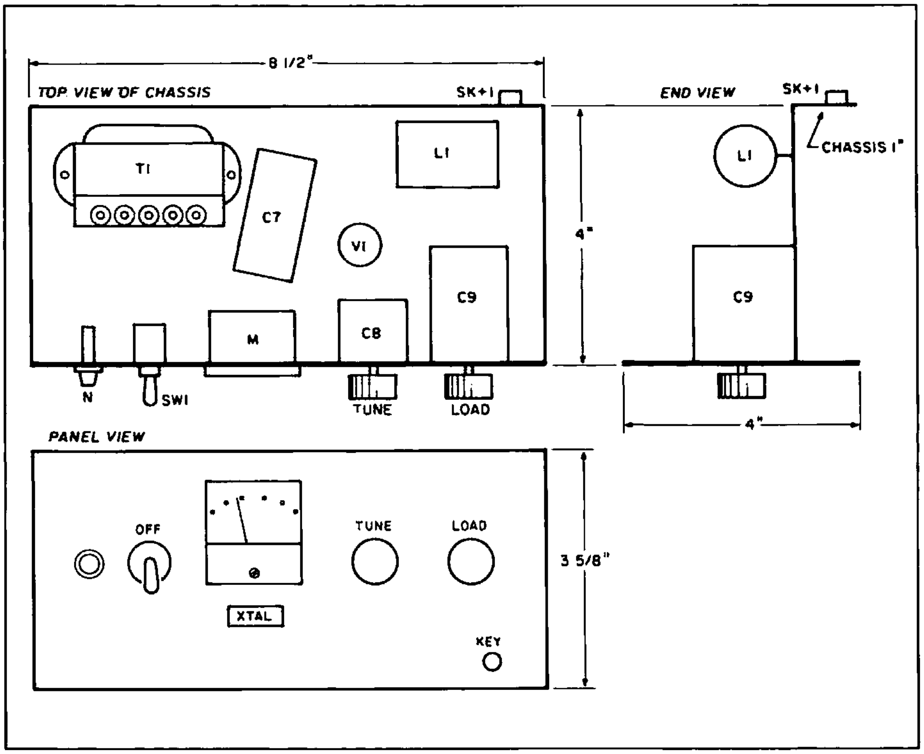

Figure 2. Panel/chassis assembly layout.

2 mA increase in current so that the crystal is oscillating smoothly. Increase the antenna load by tuning C9 for maximum current. Now listen on an RX and adjust C1 for the best keying note. Repeat all the above with an ATU and antenna in place of the dummy load. Readjust C1 for the best note. It should not be necessary to readjust C1 again unless the 6BW6 tube is replaced.

Repeat all the above with a 40 meter band crystal—*but* without any further adjustment of C1. Do not use an 80 meter crystal on 40 meters.

Remember—higher voltages are used in tube transmitters than with semi-conductors, so TAKE CARE!

With this little QRP one-tube transmitter I have been able to maintain the regular early morning QSO into Germany, and have met little difficulty in working all over Europe with an indoor antenna, providing a useful standby transmitter.

Have fun with "The QRP 80/40 Sender."

Parts List

R1	47k, 1/4 watt
R2	470 ohms, 1/2 watt
R3	12k, 1 watt
R4	100k, 1 watt
R5	100k, 1 watt
C1	3-33 pF trimmer
C2	0.01 µF/300V working minimum
C3,C4,C5	0.001 µF/300V
C6	1000 pF @ 1kV
C7	50 µF/350 volts electrolytic
C8	365 pF single gang airspaced variable capacitor
C9	365 + 365 pF two gang airspaced variable in parallel—730 pF
Crystal	3.5 & 7 MHz band crystals—FT243 with panel mounting socket
V1	6BW6 tube + B9A ceramic chassis mounting socket
D1	(Westinghouse 18RA used) any suitable type available
RFC1	2.5 mH RF choke
RFC2	9 turns close-wound PVC hook-up wire wound on 3/16" diameter rod, and removed
J1	Jack socket for Morse key plug
L1	35 turns 24 gauge enamel copper wire, spaced 1 turn and wound on 1" diameter PVC or plastic (paxolin in the U.K.) tube
N	Neon panel light
SW1	2-pole on/off switch
T1	Transformer—secondaries 1.) 250 VAC @ 60 mA (minimum) 2.) 6.3 VAC @ 1 amp (minimum)

Number 5 on your Feedback card

The Noise Remover

A simple, effective way to get rid of the static.

by Gerald F. Gronson K8MKB

There have been a number of remarks as to how a really narrowband CW filter becomes useless when a lot of "static" noise is on the band. The source doesn't matter: the result is the same. The filter becomes a tone generator and the signal you are trying to copy is lost.

One solution is the noise circuit described in this article. It is adjustable from "no effect" to "no signal out," requires no special parts, and can be made small enough to be installed in an existing add-on CW or SSB filter. It can also be used in one of the new simple receivers, such as the Sudden (see the October '91 issue, p. 8), to give the receiver a bit more performance.

The Noise-Limiter Circuit

The circuit that does the job is shown in Figure 1. Most noise-limiter circuits are of the shunt type. This one is a series limiter. The bias on the diodes is adjusted by the 10k limit adjust pot. The resistor marked 6.8 to 8.2k (a 10k/25 turn pot can be used here) is used to adjust symmetry. The capacitor is a bias filter; the 15k resistor is the output load. The 220 ohm, 0.047 µF, and 0.0047 µF capacitors form a speech range filter. The 100k output adjust potentiometer can be a trimmer or a standard audio taper "volume control."

Putting the noise limiter in the receiver ahead of any filter makes copying a signal easier. It's like closing the window a bit on the radio signals being received, but unlike a volume control, small signals get full amplification and big signals get clipped.

Three circuits are shown. With so many different situations out there it's a hard call to make as to which circuit to recommend, but it is best to place the noise limiter ahead of any filter. In the Sudden receiver, place the noise limiter ahead of the LM386. In fact, in a simple receiver, use the circuit in Figure 3. The circuit between the X's could be omitted for first-time builders. All it does is give steeper

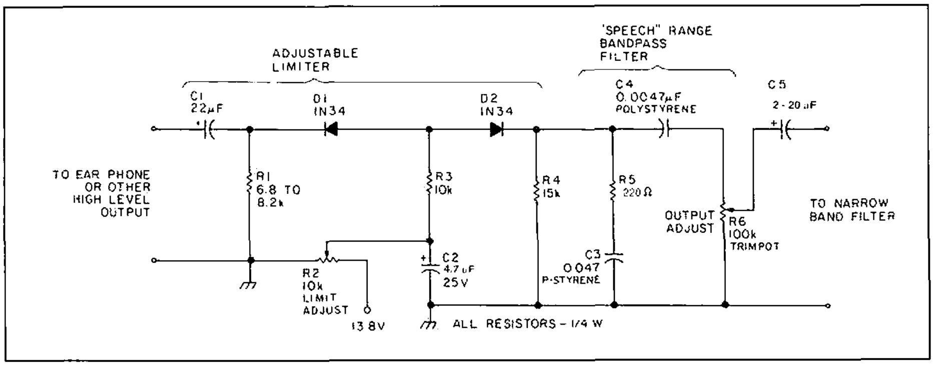

Figure 1. Noise-limiter schematic. Use this circuit if a high level signal is available and you have an "add-on" narrowband filter.

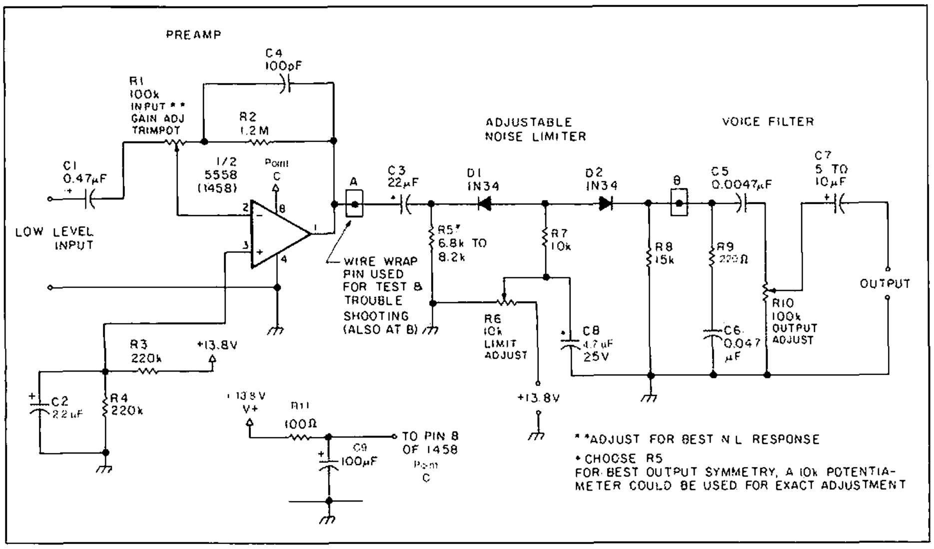

Figure 2. Schematic of the noise-limiter with a pre-amp. For a low level signal if you have an "add-on" filter such as an MFJ CW type.

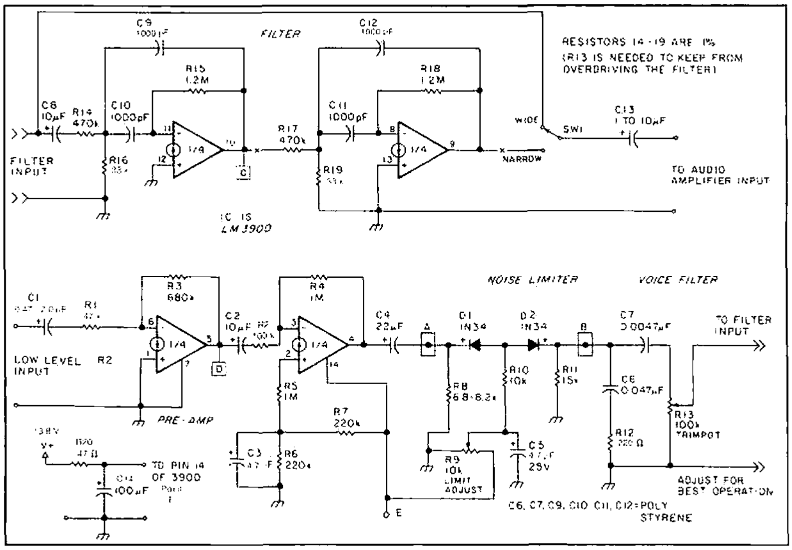

Figure 3. Schematic of the noise-limiter with a built-in amplifier and filter.

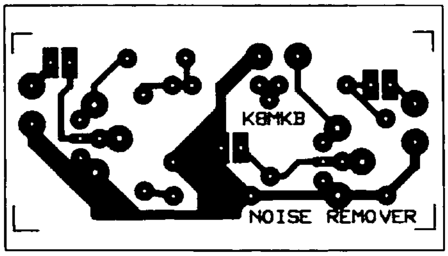

Figure 4. PC board foil pattern for the basic noise-limiter (refer to Figure 1).

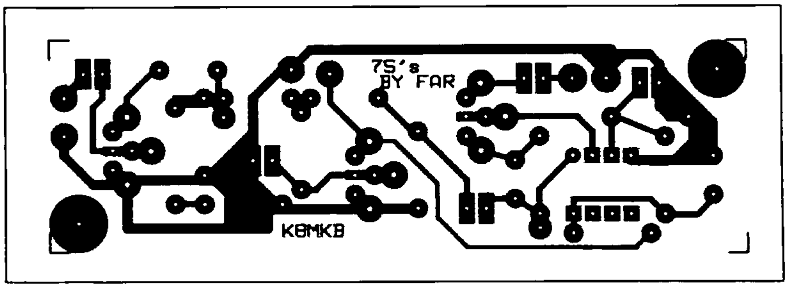

Figure 6. PC board foil pattern for the noise-limiter + filter (refer to Figure 2).

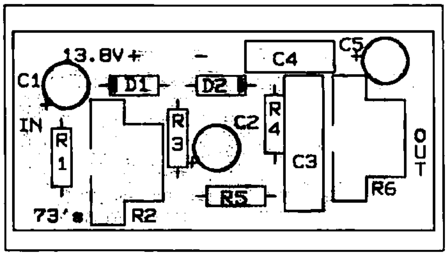

Figure 5. Parts placement for the basic noise-limiter.

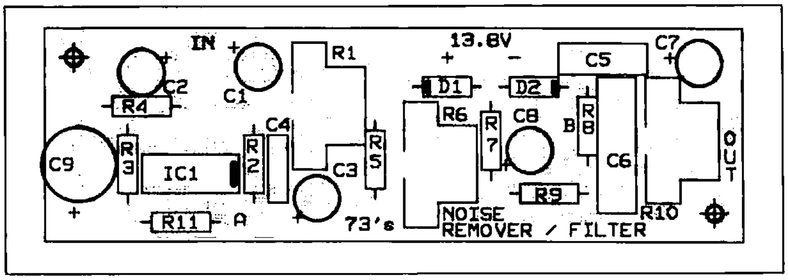

Figure 7. Parts placement for the noise-limiter + filter.

skirts to the bandpass response. It is a definite improvement, but not really necessary. The output trimpot is adjusted, in any case, to keep from overdriving the filter. Using fixed resistors that are about 35% lower in value will allow operation of the limiter on 9 volts. It could then be built into one of the existing add-on filters, such as one of the MFJ models.

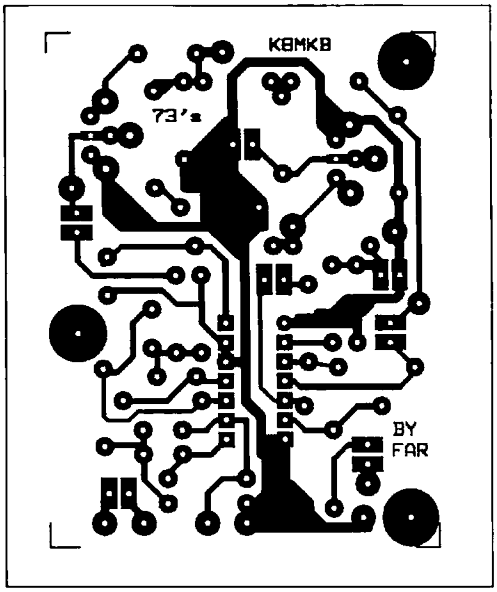

Figure 8. PC board foil pattern for the noise-limiter + filter + preamp (refer to Figure 3).

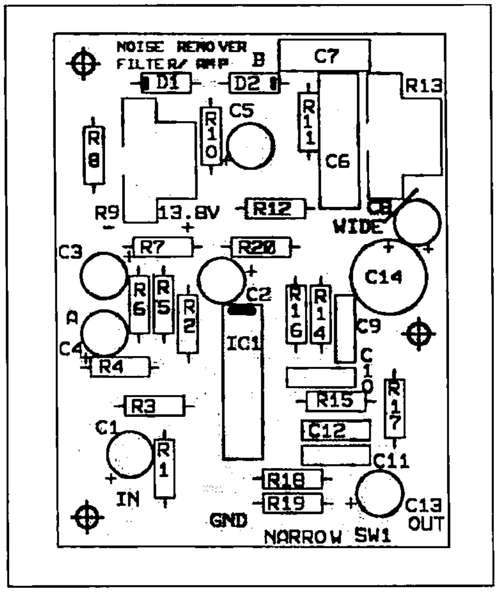

Figure 9. Parts placement for the noise-limiter + filter + preamp.

Assembly

The noise limiter can be assembled on perf board. PC boards are also available (see the parts list on page 16). Glass epoxy is preferred to paper phenolic. Use a low-watt soldering pencil, and *heat-sink the diodes*. Quarter-watt resistors are used throughout. *Poly-styrene* capacitors are used in the filter circuits, as are 1% resistors (you can get by with 5%). The squares with dots are wire wrap pins. Wire wrap pins are handy for making connections to pots, power connections, and input-output connections.

Adjustments

I used a panel mount pot for the *limit adjust* pot (R2 in Figure 1, R6 in Figure 2 and R9 in Figure 3) so I could easily adjust the noise reducer. Hook up a 10k pot in place of the resistor marked 6.8 to 8.2k (R1 in Figure 1, R5 in Figure 2 and R8 in Figure 3) for initial adjustments (you can leave the pot in place when done or measure its final value and replace it with a fixed value).

> ***"I believe that this circuit can improve copying a CW signal in a high QRN situation by between 60-80%. Try it; you'll like it."***

Tune in a signal with your receiver and set resistor R1 (marked R5 in Figure 2 and R8 in Figure 3) to 2/3 of its maximum resistance. Next, set the *limit adjust* pot (R2 in Figure 1, R6 in Figure 2 and R9 in Figure 3) to maximum. Then adjust the output pot (R6 in Figure 1, R10 in Figure 2 and R13 in Figure 3) for the optimal output level. Adjust the *limit adjust* control (R2 in Figure 1) counterclockwise until clipping occurs (listen for a definite change in the quality of the sound). Rock R1 back and forth until you hear a clean sound. From this point on you only need to adjust the *limit control* for noise reduction.

I believe that this circuit can improve copying a CW signal in a high QRN situation by between 60-80%. Try it; you'll like it. ■

See the parts list on page 16

The Noise Remover *Continued from page 14*

Parts List.

Basic Noise-Limiter (see Figure 1).	
C1	22 µF electrolytic
C2	4.7 µF/25V electrolytic
C3,C4	0.047 µF polystyrene
C4	0.0047 µF polystyrene
C5	2 to 20 µF electrolytic
R1	6.8 to 8.2k
R2	10k potentiometer
R3	10k
R4	15k
R5	220 ohm
R6	100k trim pot
D1,D2	1N34 diodes
U1	1458 op-amp IC
Noise-Limiter with Preamp (see Figure 2).	
C1	0.47 µF tantalum
C2	2.2 µF electrolytic
C3	22 µF electrolytic
C4	100 pF
C5	0.0047 µF polystyrene
C6	0.047 µF polystyrene
C7	4.7 to 10 µF electrolytic
C8	4.7 µF/25V electrolytic
C9	100 µF electrolytic
R1	100k trim potentiometer
R2	1.2 MEG
R3,R4	220k
R5	6.8k to 8.2k (choose for best symmetry or use 10k pot)
R6	10k potentiometer
R7	10k
R8	15k
R9	220 ohm
R11	100 ohm
R10	100k potentiometer
Noise-limiter + Amplifier and Filter (see Figure 3).	
C1	0.47 to 2.0 µF electrolytic
C2	10 µF electrolytic
C3	4.7 µF electrolytic
C4	22 µF electrolytic
C5	4.7 µF electrolytic
C6	0.047 polystyrene
C7	0.0047 polystyrene
C8	10 µF electrolytic
C9,C10,C11,C12	1000 pF polystyrene
C13	1 to 10 µF electrolytic
C14	100 µF electrolytic
R1	47k (or 100k potentiometer)
R2	100k
R3	680k
R4	1 MEG
R5	1 MEG
R6,R7	220k
R8	6.8 to 8.2k
R9	10k potentiometer
R10	10k
R11	15k
R12	220 ohm
R13	100k trim potentiometer
R14	470k, 1% tolerance
R15,R18	1.2 MEG, 1%
R16,R19	33k, 1%
R17	470k, 1%
R20	47 ohm
D1,D2	1N34 diodes
U1	LM3900 IC

Note: Etched and drilled PC boards are available for each version of the Noise Limiter from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The basic Noise-Limiter PC board is $3.00, the Noise Limitier + Filter is $3.75 and the Noise Limiter + Filter + Preamp is $4.00. Please add $1.50 per order for shipping/handling.

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

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An All-Band HF Mobile Antenna

Efficient and inexpensive.

by Stephen A. Glowacki KC4TMT

There are many reasons why we build antennas. Often we want something in particular that we either can't buy commercially or can't afford.

As the county's Emergency Coordinator I needed a good mobile multiband antenna. I initiated this design to favor materials available at local hardware stores. This tends to make repair easier and helps keep the overall cost down. The following mobile design can be constructed for about $20, with subsequent band coils costing less than $3-$5 each.

Much of the designing for this antenna was done with the aid of the *ARRL Antenna Book* and the *ARRL Handbook*.

Theory

The main idea behind an HF mobile antenna is to maintain the electrical length while shrinking the physical length to a practical size. The way to do this is to incorporate some sort of loading coil at either the base or the center. Each has its merits. Base loading has the advantage of physically placing the weight of the coil near the car. This avoids the need for guy connections.

I'll include some references to the math, but not many. If you really want the full outline of the calculation process and formulas, contact me and I'll be more than glad to QSO about it.

RF current is maximum at the point immediately above a loading coil. With a base-loading antenna, the efficiency is less because this current tapers off quickly as it goes toward the top of the antenna. However, with center loading, the radiation efficiency improves quite a bit. Optimum positioning is somewhere between 50%-70% up the total length of the antenna.

RF current varies with the cosine of the height in electrical degrees at any point in the base section. In a center-loaded antenna this characteristic results in more current being allowed to conduct higher up the antenna. This is more efficient, compared to a base-loaded antenna. The current then tapers off above the coil normally, resulting in an overall increase in the efficiency of the antenna.

Unfortunately, center loading requires a larger inductance than base loading in order to cancel out the increased capacitive reactance (X_c). (This increase is due to less antenna being available for resonance above the coil.) This larger inductance then requires a larger Q-factor (to maintain the same comparative radiation efficiency as a base-loaded antenna).

Photo A. Stephen Glowacki KC4TMT stands next to his mobile antenna.

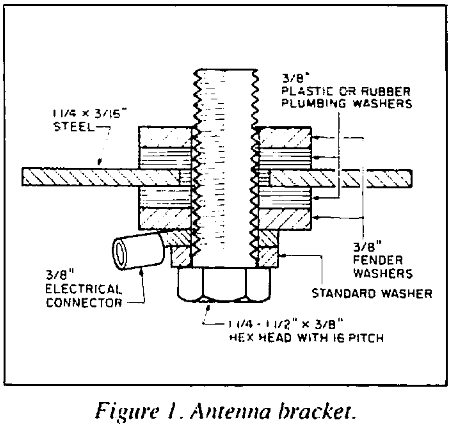


Figure 1. Antenna bracket.

This need for larger inductance and Q-factor forces the construction of physically larger coils. With placement of the coil being higher, wind-loading problems require the use of guy connections. (I hate to think in terms of guy wires when working with my car.)

Theoretically, if the coil is moved much beyond the two-thirds mark, the size of the coil would become impractically large and make it impossible for mobile use.

Most of the dimensions of this antenna resulted from the materials I had on hand at the time. The numbers are only internally significant and changes can be made easily with minor adjustments to the rest of the antenna, i.e. if you shorten the top antenna section, increase the number of turns on the coil; if you lower the position of the coil along the antenna, use less turns on the coil. (The opposite of these remedies is true for reversed conditions.)

To achieve optimum efficiency you need to balance all the characteristics of the antenna. The measurements given will put you in the ballpark, but fine-tuning is always required. Be patient in fine-tuning the antenna to your car. A good way to ensure a favorable outcome is to set plenty of time aside and follow consistently whatever procedure you devise to trim the coil.

The matching system listed here is only one of many. The general approach is to cause the antenna to be capacitive; that is, to have it resonate at a frequency slightly higher than what you want. This will also increase the impedance of the antenna. The increased capacitance can then be canceled by an inductance in the matching portion.

The opposite is also true. However, using an inductor seems to be easier—it's less sensitive to surrounding conditions and, thus, more predictable than an air capacitor.

The third approach is to use a combina-

Continued on page 21

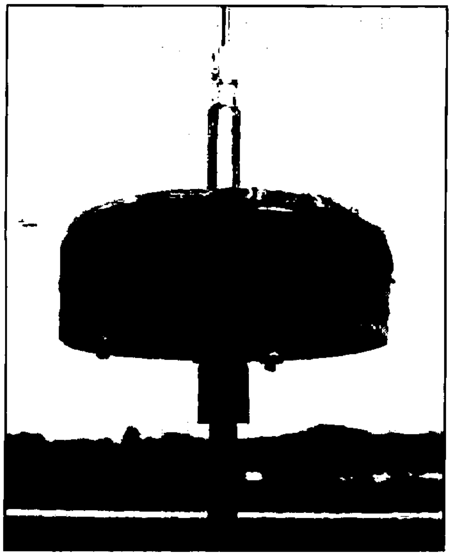


Photo B. Close-up view of the loading coil.

tion of inductance and capacitance shunted in parallel to ground. This is most effective since it is basically a custom-made antenna tuner. I recently experimented with this design and found it to be very successful. To make this addition, simply locate a variable air cap having somewhere between 15 and 600 pF and mount it either directly on the car or on an enlarged platform able to hold both. Wire them in parallel and you're ready to go.

I've been able to tune the existing center loads across each entire band with at least a 1.2:1 SWR. Not bad for a $2 addition!

Before you begin, I'd like to note that designing and building antennas is a learning experience. We've all heard the story of the damaged antenna lying on the ground that worked better than when it was on the tower. Antenna performance is not always predictable, so watch for unusual results.

There are many opinions and approaches to what works or doesn't work. What's important to remember is that the antenna is only as good as its SWR and RSTs.

Construction

Preparation and assembly of the antenna is straightforward. First gather the materials. I strongly suggest that the lower portion of the antenna be made of at least 3/8" diameter SOLID aluminum or stainless steel rod. Thinner dimensions will tend to break under the stress of driving.

The length of this rod (62-1/2") will be an overall 63-1/2" when the couplers are attached. The upper whip section measures 50-1/2" overall. This includes the coupler, so measure appropriately. If you need to deviate slightly from these figures no recalculation will be necessary, just allow more turns on the loading coil. Later you can trim the coil to accommodate the changes.

At this point you'll need a tap and die set (see the sidebar). If you don't have one the local hardware store will usually do the work for a small fee. Or visit the local high school metal shop. The teachers are often very helpful and a donation of a few pizzas to the class can go a long way. Die cut a 3/8-16 thread around both ends of the lower solid antenna portion. (Remember to keep in mind that TWO couplers are used on this section and that the overall required length is 63-1/2".)

The top antenna whip can be purchased at most radio shops or at Radio Shack; or, you may have one lying around that will work. The majority will use a 1/4-20 thread. A coupler of the same thread will be used to attach this to the top of the loading coil.

I suggest you use dielectric for all threaded connections. About a month after I installed the antenna I began having problems while tuning up. I found that this was because the threaded portions had some minor corrosion due to weather. Periodically check these connections and, if necessary, treat them with electrical sealer or doping.

Mounting Bracket

The actual mounting bracket design will depend on where you decide to place the antenna on your car. Like many cars, mine has rubber bumpers. This forced me to design a bracket using 1-1/2" x 3/32" flat steel that would be bent to mount against the body BEHIND the rear bumper.

First bend the steel to fit as you would like it. Then measure how far out it needs to be cut to support the antenna. Ensure that the steel doesn't rub against other parts of the car—this would cause static and could effect the tuning of the antenna.

After the final placement and bending is completed, drill two 7/16" holes through the steel and body of the car. Temporarily attach the bracket and determine how far out to drill the hole for mounting the antenna. Mark this spot.

The size of hole to drill here will depend on the outside diameter of the insulating tubing you use around the mounting bolt. The tubing I used had an o.d. of 1/2". This hole should allow the insulating tubing to have a snug fit, so cut the hose to the thickness of the steel plus 1/8".

Drill a second hole (1/4") about 1-1/2" from the first, toward the car. This will be for mounting the coaxial grounding connection.

After all the bending and drilling is completed, paint the bracket with as many coats of clear enamel as necessary to protect it from the weather. Set it aside to dry.

Next, attach two electrical connectors to one end of the 16-1/2" RG-58 coax: 3/8" to the center lead and 3/16" to the shielding. I suggest soldering the ground connector as close as possible to the coax. Be careful not to melt the center lead insulation.

Once the bracket is dry, assemble the 3/8" coupler as shown in Figure 1. When you tighten the coupler the plastic washers will compress against the rubber hose and electrically insulate the bolt.

Then attach the shielded side to the bracket with a 1/4" bolt. Measure the resistance between the two connections. It should be better than 10 meg. (I measured almost 250 megohms with my DMM.)

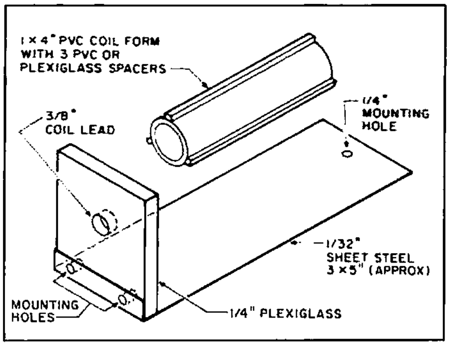


Figure 2. Matching coil platform.

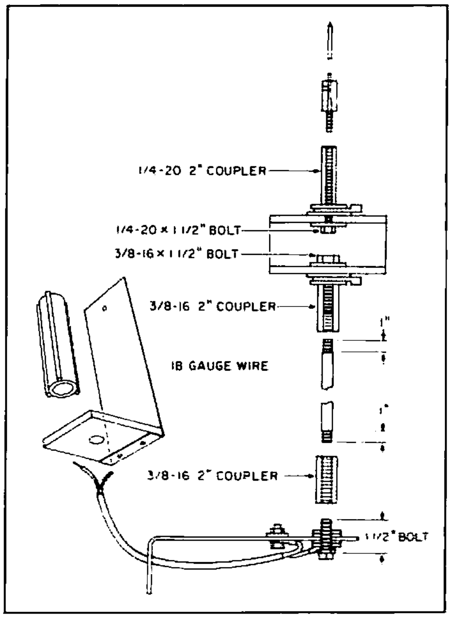


Figure 3. Overview of the mobile antenna.

Once satisfied, use electrical doping to insulate BOTH connections to stop moisture from getting into the coax and from creating a short between the two leads. This doping is commonly available at electrical supply stores.

Use 7/16" hex-head bolts and washers to mount the bracket to the body of the car. To ensure a good grounding contact, scratch off the enamel where the washers meet the bracket. Consider using Lock-tight on the bolts if excessive vibrations are a factor. These bolts should extend inside the trunk about 1" beyond the nut for attaching the grounding strap.

Finally, drill a 3/8" hole through the car body next to the bracket and install a grommet. Feed the other end of the RG-58 coax through the grommet.

This completes the mounting bracket assembly.

Matching Coil

The matching coil is designed to balance an 80 meter loading coil and higher. If you decide to use a 160 meter coil you can add more turns to the matching coil.

The coil is built around a 1" PVC pipe

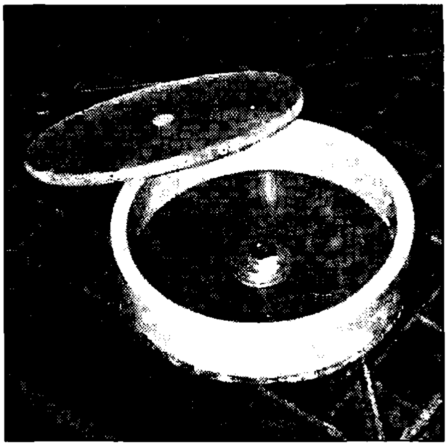


Photo C. The component parts of the loading coil form are made of a slice of PVC pipe with plexiglas end pieces.

about 4" long. From 1/4" Plexiglas™ cut 3-1/4" x 4" lengths to use as spacers. With PVC cement, glue these, equally spaced, around the PVC form. This will provide room for an alligator clip to be used later.

Wrap 14 to 15 turns of 14 or 16 gauge solid bare copper wire around this form. The width of the total turns should be 3". With a diameter of about 1-1/2", this coil should provide approximately 3.2 µH of matching inductance. Solder two electrical connectors to the leads of the coil.

Construct a mounting platform, as shown in Figure 2, using thin sheet steel and Plexiglas. Use a 3/8" bolt to attach the coil to the Plexiglas portion and a 1/4" to ground the coil to the steel portion.

This platform can be mounted almost anywhere inside your trunk provided it's within reach of the RG-58 feedline. Drill a 1/4" hole and mount this platform with a hex-head bolt. Again allow about 1" extra on the bolt length for the coil and jumper connectors.

Solder the two electrical connectors to the RG-58 antenna feed inside the trunk AFTER IT HAS BEEN FED THROUGH THE GROMMET. (7/16" for the shielding and 3/8" for the center lead.)

To make the jumper, remove the shielding from a piece of RG-58 about 6" to 7" long and solder an alligator clip to one end. Cut a length of heat shrink that will insulate all but 1/4" of this shielding and shrink it on. Slide the alligator clip's rubber cover over the heat shrink to the clip. Finally, solder a 1/4" connector to the other end of the jumper where the bare shielding extends.

Attach both the jumper and one end of the matching coil over the platform's 1/4" bolt. Attach the other end of the coil to the Plexiglas support using a 3/8" bolt (see Figure 2).

If you use 16 or 14 gauge wire for the inductor it will be able to support itself by its leads.

To finish the matching unit, cut a 6" to 7" length of RG-58 coax and connect a PL-259 connector to one end. Solder an alligator clip to the other end's center lead. Insulate the shielding with heat-shrink tubing, as before, with the jumper and attach a 7/16" electrical connector to the end. (Allow these two leads to be long enough for the center lead to extend to both sides of the matching coil when the shielding is connected to the 7/16" bracket mounting bolt.)

At this point you can add a variable capacitor. Remember to wire it in parallel and you're all set.

Loading Coil

Cut a piece of 4" PVC tubing into slices, referring to Table 1. Make these cuts as square as possible. This will determine the straightness of the antenna. Because bolts and washers extend toward the inside of the coil, the PVC slice should not be cut less than 1" wide.

Photo D. The matching coil assembly mounts inside of the vehicle. Grounding and feedline alligator clips allow for fine tuning of the resonance and impedance of the antenna.

On a sheet of 1/4" Plexiglas, outline two disks for each loading coil by using one of the slices as a guide. I've had excellent results using a saber saw with a moderate tooth blade (12/inch) under moderate pressure. This should avoid chipping but may create melting. Pliers can be used to pull off the melted excess.

Drill a 3/16" hole through both disks at the same time to help center the antenna studs. Then drill one of these to 5/16". Drill carefully to avoid chipping or cracking. For added strength, drill three holes in a triangular pattern through both disks. The holes should be about 5/8" in from the edge to provide clearance for the PVC tubing thickness (1/4"). The size of these holes depends on the size of the plastic bolts you'll be using. I strongly suggest that you tap these holes to allow the bolts to thread. Plastic bolts aren't very strong and the added benefit will be needed.

Tap the center 3/16" and 5/16" holes to 1/4"-20 and 3/8"-16 thread, respectively. Using fender washers to help disperse the pressure, thread each bolt through to ensure a clean tap. Back the bolts out about 1/4" and apply a generous amount of instant glue to the threads. Re-tighten to a snug fit.

Placing the threads outward, glue the two disks to a PVC slice with five-minute epoxy (clear type) and let them dry. An important point when gluing is to have all the pieces under moderate pressure to ensure a tight bond. To do this, thread the plastic bolts through and tighten them before the glue dries. DO NOT USE METAL BOLTS FOR THIS—they will interact with the loading coil and could distort the radiation pattern.

Once dry, solder a 1/4" electrical connector to one end of the 18 gauge enamel wire that will be used for the coil. Bolt this to the top part of the coil form using spacing washers and the 1/4" coupler.

With a flat iron tip melt a groove into the edge of the top Plexiglas disk. Press the enamel wire into the groove while it's still soft. This will stop the coil from unraveling. Wrap with an appropriate number of turns for the band you've chosen. Try and keep the turns as tight as possible and pressed together.

Use plenty of electrical tape to temporarily hold the coil wire in place. Mount the 3/8" connector to the lower side as you did with the top side, but don't solder the enamel wire—you'll need it loose for tuning later on.

Fine-Tuning

Attach an SWR meter to the matching coil's PL-259 connector. Hook up your radio as it would normally be and attach the feedline to the other side of the SWR meter. The feedline alligator clip should be attached to the ungrounded side of the matching coil where the antenna feedline is connected. The coil's grounding jumper should be unconnected. (You can clip it to the end of the PVC form.)

Assemble the antenna and attach it to the coupler on the mounting bracket. (I added a second support higher up to allow the lower antenna to stay permanently on the car.) (See Figure 3.)

File the enamel off the tip of the lower loading coil wire that isn't attached. Use an alligator clip to temporarily hold the con-

Table 1. Center Coil Dimensions				
Band	**Turns**	**Coil Length**	**Form Length**	**PVC Diameter**
160	62	2.75"	2.875"	4.5"
80	23.75	1"	1.125"	4.5"
40	10.25	0.5"	1"	4.5"
20	7.50	0.5"	2.5"	2.375"
15	2.80	0.125"	2"	1.875"
10	No center coil necessary; join the two rods together with a coupler.			

nection for tuning. The clip should not have any wire attached to it.

Check for the best SWR. 100 kHz down from the center frequency you want the antenna to resonate at. Adjust by clipping one quarter turn at a time, each time checking the SWR. Don't test by shorting the loading coil—this will degrade the efficiency of the coil and give false readings.

Once you get near the null (where the SWR begins to dip) adjust to your desired frequency and continue by clipping 1/4" to 1/2" at a time. Each quarter turn should increase the resonance by about 50 kHz while half-inch snips should be 10 kHz.

Once you are satisfied, remove the coil and solder the enamel wire to the lower connector. Reassemble and check the SWR. If there are any problems you'll need to restart the fine-tuning from the beginning, and possibly rewrap the coil.

Repeat this process for each band coil. Try not to change the matching unit. The goal is for the coil to be the only necessary change to switch bands.

The matching coil alligator clips are used for within-band adjustments. These will allow for adjusting the SWR within a small range after the overall tuning is complete. The feedline clip is used to balance the matching coil, while the jumper is used to adjust the inductance. You'll need to be patient to successfully tune to different frequencies.

The results could be marked by paired colors, 1/8" jumpers could be soldered to the matching coil at these points for easier reference, or a two-pole rotary switch could be used to make band switching quick and easy.

If you choose to include the variable capacitor in the matching system you'll have more leeway. (The grounding jumper wasn't necessary when I made this addition later.)

Whatever you do, the shorter the leads are the better. Everything effects the antenna. Even the 16-1/2" feedline is part of the antenna and will effect the tuning if it is changed.

Hot glue or five-minute epoxy could be spread on the enamel wire once all tuning is complete. I haven't been able to find heat-shrink tubing big enough to fit over the coil, although this would be best. If you use 2" PVC or smaller for the loading coil form, 3" heat-shrink tubing is available from Electronic Surplus (R&D Electronics) in Cleveland, Ohio.

Finishing

The guy connection I'll leave up to you. High strength fishing line, thin rope, or mason line are all good choices. Either way, guys are necessary to avoid damage. I suggest using two support lines.

I've had many S7-9 reports within a 400-mile radius of my West Virginia QTH on the 80 and 40 meter bands. On the 15 and 20 meter bands I was able to QSO with stations in France and Germany while traveling through northern Ohio.

Although commercial designs may have a 20% improved bandwidth, the quality of this design should meet your needs.

I'm interested to hear of any changes you make to the design, including the matching system, and would appreciate hearing from you about your results. Good luck! 73s.

Contact Stephen A. Glowacki at Rt. #3, 205 Hickory Drive, Elkins WV 26241.

Tap and Die

If you're not familiar with the mechanics of a tap and die, no problem. The procedure is straightforward.

First locate the proper size of die. (This is what cuts the threads into a rod to make it resemble a bolt.) Using the 3/8"-16 size as an example, the first number measures the diameter of the outside of the threads, and the second number tells how many threads there are per inch. These numbers appear on the die itself, which can be purchased individually for about $2.

You need a handle to hold the die steady during the process. These cost about $8-$15, depending on the style.

If you want to save money, Sears has a 20-piece Homeowners Set for under $20, available through their catalog store. Whatever you buy, just make sure that the 3/8"-16 and 14"-20 are part of the set. These are common sizes used in amateur radio.

The technique for cutting with a die is simple. Brace the rod steady either in a vise or with Vise-Grip pliers. (I used the latter, attaching the pliers near the base of the rod and then standing on them for bracing.)

Placing the **wide** side of the die toward the rod, turn slowly but with pressure. You'll feel it cut into the aluminum almost immediately.

Make sure that the first two to three thread cuts are square so that the die remains perpendicular to the rod.

The die needs to remain square to the rod **while** it is turning. This is the most difficult part of the whole process. Once the first two to three threads are cut, the rest is easy.

Now the turning technique: Turn the handle clockwise 90 degrees, then reverse and turn back until you feel the metal filings snap. (About 30-40 degrees.) Then, turn clockwise another 90 degrees and again reverse to snap off the filings. Continue this process until the proper length is cut. I find it easier if I imagine north, east, south and west and keep to those points.

It may be necessary to turn continuously for the first thread or so to help the die take hold. Don't be afraid to back off and start again.

Once the cutting is started, have some lubricant available and apply moderately. There are certain lubricants preferred for some metals. Generally, a light oil or kerosene is good for aluminum and stainless steel.

Number 7 on your Feedback card

by Bill Clarke WA4BLC

Japan Radio Co., Ltd.
430 Park Ave., 2nd Floor
New York NY 10022
Telephone: (212) 355-1180
Fax: (212) 319-5227
Price Class: $4,899

The JRL-2000F HF MOSFET Linear Amplifier

A solid-state, no-tune kilowatt with very advanced features.

The JRL-2000F is built by the Japan Radio Co., Ltd. (JRC). It is a microprocessor-controlled solid-state no-tune HF linear amplifier capable of producing a solid 1,000 watts output.

Photo A. The JRL-2000F solid-state kilowatt amplifier.

When the 2000F arrived it was in a single box and well packaged inside same. The weight of the box was a formidable 78 lbs. and you should be forewarned not to attempt to place this amplifier on anything less than a desk or surface designed for battleship purposes. I used two heavy-duty milk crates. Due to its weight, this unit cannot be shipped by UPS. It arrived at my door via Federal Express (FEDEX).

There is nothing to assemble with the amplifier. It is ready to go as soon as it is unpacked. No tube(s) or transformer(s) to install. Strictly plug 'n go!

The 2000F comes with a remote hand control, resembling a TV remote control, which can completely operate the amplifier.

Initial Testing

For initial testing I used the JST-135 (also from JRC) transceiver. Through an interconnection cable, the 135 converses directly with the amplifier for band/frequency information and control.

The 2000F is a complex and modern device, although from the operational point of view it is about as simple as you can get. A pre-made cable (optional) is connected between the exciter and the amplifier for control (it contains a few more wires than the usual transmit relay control line) and a coax jumper for bringing the RF input to the amp.

The antenna system is connected to the four antenna ports on the back of the amp. In the case of this testing I utilized them in the following manner: 80/40 dipole, Cushcraft R5 vertical, 160 meter dipole, and 80-10 meter Windom. No external antenna tuner was placed in the line.

My first operation was on 75 meters. It took about 10 seconds for the amplifier to set itself up for the band segment being operated on. Later return to this segment required only an instant for retuning.

Signal reports were excellent. No mention was made of poor signal, low audio quality, reduced power, or distortion. A single 3-500 (1 kW output) tube-based amplifier was used for on-the-air comparison of signal reports.

Fan noise was not mentioned by anyone. Nevertheless, depending upon physical placement of the amplifier, I believe fan noise could prove to be a problem. However, the 2000F is not the only amplifier to suffer from fan noise. The problem applies to nearly all HF amateur amplifiers.

The typical efficiency of the 2000F appears to be about 60 percent. This is based upon meter readings of 22A current at 80 VDC during key-down, with an output of 1 kW.

Antenna control is done by the 2000F. Manual selection is made by pushing buttons on the front of the amplifier. Later recall of previous operation on the same (or nearby) frequency will cause the amplifier to select the originally chosen antenna automatically (this can be overridden by the manual controls).

After using the JST-135/JRL-2000F combination on several bands and enjoying the complete ease of fully automatic tune-up and antenna change, I built connector cables for use with my ICOM 751A and Corsair II. The cables must provide, in addition to the normal ALC and PTT lines, a talk-back line. The latter forces the exciter into transmit during tune-up or after QSY.

Tune-up is still super simple. For example, to change from 40 meters to 75 meters you merely push the 2000F's SET button to sample the frequency of operation (not required when using the JST-135, due to the feedback data line between the transceiver and the amplifier). In SSB mode it is necessary to say a word or two (ie: "ahhhhh!") so the amplifier can determine the operating frequency. Once the frequency is determined, the 2000F will tune itself, based on prior usage at that frequency.

Once the band segments for my favorite frequencies had been programmed into memory, I found the ICOM and Ten-Tec to be nearly as dexterous with the JRL-2000F as is the JST-135, the only difference being the requirement for pushing the SET button and announcing yourself each time you QSY.

The ease of the 2000F's automatic tuning and antenna selection brings this HF linear amplifier into the realm of the instant QSY we are all used to with solid-state transceivers. I found that when jumping from 14.300 to 3.950, the amplifier tuning and the switching of the antenna line took about three seconds when using the ICOM 751A. Just punch the new frequency into the 751's keypad and press ENTER, then press SET on the 2000F and say "ahhhhh." It really is that easy! QSYing with the Ten-Tec took slightly longer as its tuning knob and band selector switch must both be used when changing frequency.

Throughout the testing period I was always on the lookout for a glitch to rear its ugly head, yet none ever appeared. Performance was flawless.

Points of Interest

The 2000F can be used as an antenna switch; switch and tuner; or switch, tuner, and amplifier. Each section is separate in operation but they are linked operationally via microprocessor control.

Switch selections provide for power on/off, standby, tune (automatic antenna tuner), antenna selection, and set (storage/selection of current operating parameters).

Two front panel meters provide selectable monitoring of output power or VSWR and current, voltage, or ALC.

LED indicators monitor drive levels and XMIT, indicate antenna match, and show the selected

antenna. A central display indicates the frequency in use and produces coded messages in case of trouble.

The amplifier is designed for a 1 kW output and typical readings of the output show that the 2000F easily reaches this specification.

Although the 2000F is equipped with a "high-speed arrestor" for protection against lightning surge pulses, I would not trust this expensive device to the whims of nature by relying upon anything less than complete disconnect during storms.

Instruction Manual

The JRL-2000F's manual is rather stark when compared to the volumes of paper typically accompanying a modern piece of HF equipment. It is, just the same, very adequate. After all, the 2000F does nearly everything for you automatically.

Once I understood the initial connections and settings, I only found it necessary to refer back to the manual to decode alarm messages when they appeared on the LCD readout (very infrequent and always, in my case, indicative of an operator error).

Maintenance instructions for cleaning the air filters and a troubleshooting chart are part of the manual.

A publication describing JRC's design theory and operation of the 2000F is also provided. It is straightforward, easy to understand, and is not couched in technical language.

MOSFET Design

Japan Radio Company describes the 2000F as using 48 MOSFETS in the PA section, which consists of four wideband 250W power amplifiers (each has 12 MOSFETS). The PA circuits are SEPP (single ended push-pull) design, providing greater efficiency than standard bipolar transistor/transformer coupled push-pull circuits. The design of the PA focuses on ease of impedance matching for input/output and linearity.

Bias control for the MOSFET SEPP design in class AB operation requires a high gate voltage and high drain idle current. This results in low high-order IMD and a non-critical bias voltage setting. The bias of the 2000F is controlled partially by the excitation voltage to achieve extreme stability.

The cooling system for the MOSFET amplifier is based upon heat-resistant MOSFETS and temperature actuated fans. The fans are rear facing and generally quiet.

Antenna Tuning

The antenna tuner is microprocessor-controlled and consists of coils, capacitors, and relays (30 on the tuner board). Operation consists of sampling the output frequency of the exciter and checking for previous operation on the same frequency.

The 2000F has a memory matrix consisting of a possible four antennas and 455 HF subbands (70 of which are indicated as within the ham bands in the manual). What this means is that each band is split into small segments.

When operating in a particular band segment the unit will search its memory for information matching the frequency. If the unit recognizes the

particular frequency (or another within the same subband) it will set itself to the previous settings and antenna selection. If not, you will be required to enter this information before operation (takes only a few seconds and is fully automated).

Antenna selection is a part of the 2000F's tuning as the four antenna inputs are microprocessor-controlled. For example: On 14.300 MHz you always use your trusty tribander and select that antenna when tuning the amplifier. From that point, until you tell the 2000F otherwise, the tribander will always be selected when operating 14.300 MHz.

The antenna selection relays are contained in a separate shielded box on the rear panel of the amplifier's chassis.

The important band information is written into an EEPROM (a ROM chip that can be electrically rewritten) during the TUNE operation. This information will always be available and won't disappear when the power is turned off.

The data for the various operating states of the JRL-2000F (power, PA, meter settings, antenna switch settings, frequency band settings, etc.) are stored in battery-backed RAM. Memory backup is provided by a rechargeable battery which will keep the RAM fresh for a period of two weeks if the unit is unplugged from AC power. When the battery discharges your operation settings are lost: however, normal operation can be restored by using the SET procedure. Battery recharge is automatic during normal operation.

Power Supply

The power supply is designed to use 220 VAC and provide 80 VDC at 30A for the PA. Additionally, it produces 12 VDC (positive and negative) for the control circuits. By using a switching power supply, JRC claims efficiency of 90% or more. The power supply is cooled by its own fan and is professed to be capable of continuous operation at 2.4 kW.

The AC line voltage required for operation is, according to the various manuals and information sheets I received with the 2000F, ambiguous. In the written information an indication is made that AC of 50/60 Hz from 85 through 264V will operate the unit, yet attention is later drawn to reduced output power at lower input voltages (i.e. 100-120 VAC for 750W). All testing at this station was done at 220 VAC line voltage, which I consider the standard for 1 kW and above amplifiers.

Specifications

Operating bands	160m
	80m
	40m
	30m
	20m
	17m
	12m*
	10m*
Input impedance	50 ohms
Output impedance	50 ohms
Output power	1 kW (SSB/CW/RTTY)
VSWR	Less than 3.0 (16.7 - 150 ohms)
Unwanted radiation	-60 dB or less (below PEP)
IMD	-35 dB or less (below PEP)
Excitation power	100W (max.)
Freq. change time	Less than 0.1 sec.
Power supply	220 VAC 50/60 Hz (see text)
Power consumption	2.5 kVA at 1 kW
Input power factor	Greater than 95% at 1 kW
Temperature range	-10 to +40 degrees C
Protection items	Excessive PA current
	PA overheat
	Excessive exciter power
	PA abnormal load
	Excessive AC voltage
	Power supply overheat
	PA failure
	Excessive VSWR
Dimensions	430 x 300 x 420 cm/
	16.8x 11.7 x 16.4 in. (WHD)
Weight	28 kg/62 lbs.

*Contact JRC in New York for further information.

Service

I was concerned about service for the 2000F since there is not a plethora of JRC dealer/service centers and the unit is very complex (i.e. not user-serviceable).

JRC informs me there is no problem in obtaining service, as the Raytheon Service Company of New York, service center for JRC's commercial and marine amplifiers, will service the JRL-2000F. This is reassuring, as the name Raytheon is recognizable and the 2000F is based upon the commercial/marine amplifiers routinely serviced by them.

My Recommendation

The 2000F is a class act that the competition will find very difficult to follow. It does its job well, appears to be solid in design and manufacture, and exemplifies the term state-of-the-art. Would I like to have a 2000F residing in my station? Yes. If I had some easily earned dollars, I would immediately purchase one!

The 2000F amplifier does operate as intended. In fact, it does it very well and includes many features not available on any other HF amplifier. Additionally, I experienced no problems whatsoever while testing it for nearly two months.

I cannot compare the design of the 2000F to that of models from competitive manufacturers, as none offer an amplifier as advanced or feature-filled as the JRC product. There are good solid-state amplifiers and auto-tune tube-type amplifiers currently available on the market, but none provide the overall features of the 2000F.

I cannot accurately say that JRC's design will provide long and trouble-free service. There is no history, yet, to base the assumption on. However, I note that the company manufactures commercial HF amplifiers of a similar design which appear to have a good service track record.

The 2000F is not an amplifier for everyone and I can only leave the choice of such an expensive purchase to the individual. I would say, however, that when contesting and/or chasing DX, the ability to instantly QSY and make antenna selections automatically could be very valuable. Furthermore, the hands-off operation is enhanced by use of the remote hand control.

Availability

The JRL-2000F is available from ham radio suppliers. The suggested list price is $4,899; however, the street price is considerably below that.

Spread Spectrum Primer

What is spread spectrum, anyway?

by Randy Roberts KC6YJY (ex-WA6BFN)

Spread spectrum uses wideband, noise-like signals. Because spread spectrum signals are noise-like, they are hard to detect. Spread spectrum signals are also hard to intercept or demodulate. Further, spread spectrum signals are harder to jam (interfere with) than narrowband signals. These low detectability and anti-jam features are why the military has used spread spectrum for so many years. Spread signals are intentionally made to be much wider-band than the information they are carrying to make them more noise-like.

Spread spectrum signals use fast codes that run many times the information bandwidth or data rate. These special "Spreading" codes are called "Pseudo Random" or "Pseudo Noise" codes.

Spread spectrum transmitters use the same transmit power levels as narrowband transmitters. Because spread spectrum signals are so wide, they transmit at a much lower watts-per-hertz power density than narrowband transmitters. This lower power density gives spread signals a big plus. Spread and narrowband signals can occupy the same band, with little or no interference. This capability is the main reason for all the interest in spread spectrum today.

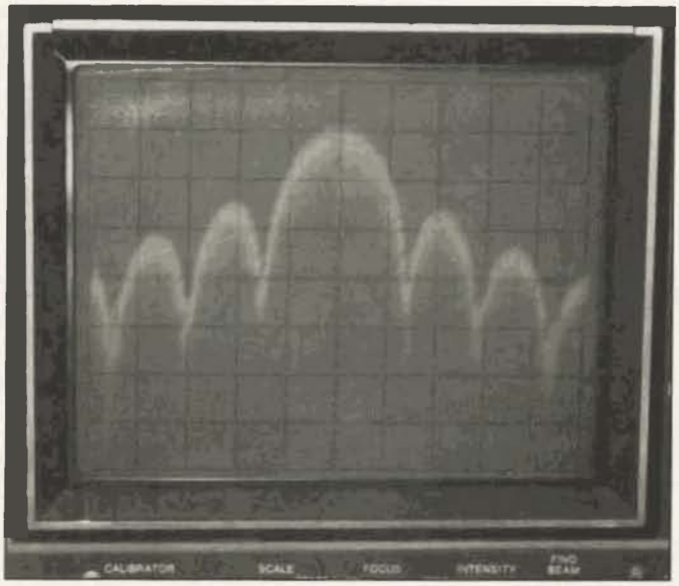


Photo A. Direct sequence spread spectrum signal (un-filtered BPSK). Note the suppressed carrier. Center freq.= 52 MHz with a 15 megabit/second PN (31 stage PN generator). Horiz. scale = 1 MHz/div. Vert. scale = 10 dB/div.

What's Spread Spectrum?

Spread spectrum radio communication is igniting much discussion and speculation lately. In the last few years there has been a lot of media attention, congressional interest (*IEEE Spectrum*, "Spread Spectrum Goes Commercial," August 1990, by Donald L. Schilling, Raymond L. Pickholtz and Laurence B. Milstein, pp. 40-45), FCC rulemaking, commercial product announcements and marketing hoopla about this exciting new field. Several very good articles on spread spectrum (SS) have appeared in ham radio literature and the ARRL's *Spread Spectrum Sourcebook* has been in print for several years now. With all of this activity you may still have a few questions about spread spectrum, how it applies to hams, how it works and in general what all this alphabet soup (like PCN, PCS, CDMA, TDMA and frequency hopping) is all about. See the sidebar for a definitive guide. This article is intended to gently lead you through some of the practical details of today's modern commercial (and soon to be ham) radio spread spectrum technology and help you gain a basic understanding of the principles involved in SS.

In 1983 the FCC issued a notice of proposed rule making authorizing the low power use of spread spectrum techniques on a shared frequency basis in the Industrial, Scientific and Medical (ISM) frequency bands of 900, 2400 and 5500 MHz. These bands are also shared with amateur radio operations—so we hams have a direct stake in what happens with this kind of equipment. Since 1983 the FCC has revised and clarified the rules for spread spectrum operation under Part 15 of their rules. Hams have been able to legally use spread spectrum under Part 97 rules for a number of years, also. However, the FCC rules for ham spread spectrum have been quite restrictive and have had the net effect of almost eliminating ham radio experimentation in spread spectrum techniques. Recent commercial developments with Part 15 equipment and a new FCC Special Temporary Authority (STA) (R. A. Buaas K6KGS request for STA, FCC file number 7230-A, granted April 17, 1992) provide a renewed impetus to the amateur community to make more use of spread spectrum techniques. In light of the possible awakening of a ham spread spectrum community, I hope to spur some interest in the ham builder/experimenter to put some of these ideas to practical use.

More About Spread Spectrum

Simply put, spread spectrum trades a wider transmission bandwidth for better signal-to-noise ratio and reduced transmitted power density. Two types of spread spectrum implementation are in fairly common use today: Frequency Hopped and Direct Sequence. Frequency hop (FH) and direct sequence (DS) are pretty well known, mature techniques today. Other more exotic forms of spread spectrum such as chirp, time hopping and hybrids of frequency hop and direct sequence are not in general use in low-cost Part 15 equipment and will probably remain only in the military province for several more years. The following paragraphs will describe frequency hop and direct sequence techniques in a little more detail and show that pseudo-noise code techniques provide the common thread through all spread spectrum types.

Frequency Hop

Frequency hopping can provide the easiest method of utilizing spread spectrum. Any radio with a digitally controlled frequency synthesizer can (theoretically) be converted to a frequency hopper. This conversion requires the addition of a pseudo noise code generator that is used to select the frequencies for transmission or reception. Most hopping systems utilize uniform frequency hopping over a band of frequencies. This is not absolutely necessary if both the transmitter and receiver of the system know in advance what frequencies are to be skipped. Thus, a frequency hopper in, say, 2 meters could be made that would skip over commonly used repeater input and output frequency pairs. A frequency hopped system can use analog or digital carrier modulation and can be designed using conventional narrowband radio techniques. Dehopping in the receiver is done by a synchronized PN code generator which drives the receiver's local oscillator frequency synthesizer.

Direct Sequence

The most practical, all-digital version of spread spectrum is direct sequence. A direct sequence system uses a locally generated pseudo noise code to encode digital data to be transmitted. The local code is generated at a rate of 10 to 100 times the data rate to be transmitted. Data for transmission is simply exclusive-OR'd with the faster pseudo noise code. The composite pseudo noise and data can be passed through a data scrambler to randomize the output spectrum (and thereby remove discrete spectral lines). A direct sequence modulator is then used to double sideband suppressed carrier modulate (also called Binary Phase Shift Keying—BPSK) the carrier frequency to be transmitted, resulting in a signal spectrum as shown in Photo A. Other forms of carrier modulation are possible with di-

rect sequence, however BPSK or differential phase shift keying (DPSK) are the simplest and most often used techniques.

A spread spectrum receiver uses a locally generated replica pseudo noise code along with a receiver correlator to separate out only the desired coded information or messages from all possible signals. A spread spectrum correlator can functionally be thought of as a very special matched filter—it responds only to signals that are encoded with a pseudo noise code that matches its own locally generated replica code. Thus, a spread spectrum correlator can be "tuned" to different codes simply by changing its local code. This correlator does not respond to man-made, natural or artificial noise or interference. It responds only to spread spectrum signals with identical matched signal characteristics and encoded with the identical pseudo noise code.

Why use the wideband signals—isn't narrowband CW or packet better? The use of these special codes in spread spectrum communications makes signals appear as wideband, noise-like signals on a spectrum analyzer. It is this very characteristic that inherently makes spread spectrum signals hard to detect or demodulate. In other words, spread spectrum signals are harder to detect on narrowband equipment because the signal's energy is spread over a bandwidth of maybe 100 times the information bandwidth.

The spread of energy over a wide band of frequencies makes spread spectrum signals very unlikely to interfere with narrowband co-channel or adjacent channel communications. Narrowband communications, conversely, cause little to no interference to spread spectrum communications systems because the correlation receiver effectively integrates over a very wide bandwidth to recover a spread spectrum signal. The correlator actually then "spreads" out a narrowband interferer over the receiver's total detection bandwidth and thus only the total integrated signal density or signal-to-noise ratio determines whether there will be interference or not. All spread spectrum systems have a threshold or tolerance level of interference beyond which useful communication ceases. This tolerance level or threshold is related to the spread spectrum processing gain. Processing gain is the ratio of the radio frequency (RF) bandwidth to the information bandwidth.

Typical SS anti-jam (AJ) radios have a processing gain of from 10 to 20 dB, depending on the data rate. They can tolerate total jammer power levels of from 0 to 8 or 10 dB (jamming margin) stronger than the desired signal. Yes, the system can work at negative signal-to-noise ra-

lios in the RF bandwidth (signals buried in the noise) because of the processing gain of the receiver's correlator.

Besides being hard to intercept and jam, spread spectrum signals are hard to exploit or spoof. One cannot get any useful information from a scanner tuned to a spread spectrum signal. Spread spectrum signals also are naturally more secure than narrowband radio communications. Thus, spread spectrum signals can be made to have any degree of message privacy that is desired—you can have all the private channels you want with spread spectrum. The very nature of spread spectrum allows military or intelligence levels of privacy and security, if desired, to be had with minimal complexity.

Frequency Re-Use and Multiple Access

Multiple spread spectrum signals on the same frequency or in the same frequency band can be accommodated through various techniques of multiple access or diversity. The nature of PN codes and correlators allow what is called CDMA (code division multiple access). Time division multiple access is also commonly used with spread spectrum. Frequency and space or polarization are also used to increase the number of users or network size of spread spectrum networks. Sometimes combinations of the above multiple access techniques are used to achieve special system characteristics.

Multiple access techniques can provide for frequency re-use, elimination or reduction of interference, increased system capacity, or to provide for "private" channels. The newest methods for digital cellular, micro-cell and worldwide LEO satellite mobile communications will use SS and CDMA or TDMA to efficiently utilize the frequency spectrum they will be allocated. Commercial voice and data PCNs and PCS's that operate over cordless telephone-like ranges of up to 5,000 feet between micro or nano cell sites will also use various SS multiple access techniques to achieve frequency re-use and spectral efficiency.

Finally and most importantly, the major benefit of spread spectrum communication is that data communications can be provided at data rates of 10 or 20 times normal wired or narrowband radio communications rates, with automatic protocols that virtually eliminate bit and message errors. Thus, digital voice, computer-to-computer, BBS, networking and other demanding communications can be provided error-free at a reasonable cost. This data reliability and integrity are the most important reasons for spread spectrum communications.

Now, the Catch

Sold on spread spectrum yet? Sounds great doesn't it? Note, however, that above I described how each type of spread spectrum worked when each receiver was presumed to have PN synchronization with its companion transmitter. This requirement for PN sync is what makes spread spectrum system design tough. There are three major problems in spread spectrum PN systems: acquisition, synchronization and tracking. All three problems are part of the general problem of estimation and/or tracking of PN code phase (timing) and frequency. These problems cause all the complexity that is associated with PN system operations. Sync problems are slightly different with each type of spread spectrum, but the main problem is the same. How does a receiver's PN generator rapidly, without significant loss of data, lock onto and track changes in a transmitter's PN code generator? A complete answer to this question is really beyond the scope of this introductory article; however, the secret lies in the design of the receiver correlator and its related processing. Current commercial Part 15 equipment uses both serial (sequential or trial and error) and parallel digital correlators. Many of these commercial designs use custom ASIC or LSI chips to accomplish the required PN acquisition and tracking operations.

Interfacing and Networking

The latest generation of commercial Part 15 SS radios, some soon to be available to hams (in a private correspondence with Mr. Dewayne Hendricks WA8DZP, president of Tetherless Access, Ltd., in February 1992, Dewayne stated that Tetherless radios will soon be available to hams through PacComm in Florida), are easily interfaced to any asynchronous communications equipment at data rates up to several hundred kB/sec. No special interface circuitry is required. The radio transmits and receives in half duplex mode—that is, it either transmits or receives data at any instant of time. The terminal hooked to the radio determines whether the radio is transmitting or receiving by setting the "Request to Send" line. Several options are available for hardware/software handshaking with the "Clear to Send" and "Device Carrier Detect" signal lines. To summarize the typical SS radio capability, the equipment can be thought of as a radio combined with a digital modem and a form of packet-radio-like TNC. Several of the commercially available SS radios (some of the more commonly available commercial SS radios are sold by GRE America, Symbol Technologies, Proxim, Senses Data Corporation, Cylink, O'Neil Communications and Qualcomm) include AX.25, X.25 or TCP/IP networking protocols software or firmware. At the current time these radios can use small networks that can be built up, entirely by software, with up to 32 or more network nodes, thus providing limited PCN/PCS capabilities. Typical SS radios in the network can be designated to be a digipeater (a store-and-forward, single-frequency repeater) by software. Several digipeaters can also be connected in tandem to extend network communications well beyond simple "line of sight" radio ranges.

Continued on page 77

Number 9 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
P.O Box 2508
Fullerton CA 92633

What's That Whirligig?

"Do you have a TV in your car?" Questions like that from passers-by are common when hams gather for hidden transmitter hunts, usually called foxhunts or T-hunts. The yagis and quads that most competitors in my area use for 2 meter radio direction finding (RDF) look a lot like television antennas, so they are big-time attention-getters. No one gets more stares than JaMi Smith KK6CU of Pasadena, California. His quad is long, tall, and continuously spinning at 40 rpm!

Last month's column showed how a display with a storage type cathode ray tube (CRT) gives far more useful RDF data than an S-meter when you're hunting with a beam. The concept, originally used on the ham bands by the late Jim Davis W6DTR, has been updated and improved by KK6CU. He motorized his antenna for continuous rotation and bearing readout.

This month you'll see how JaMi built up his system from inexpensive surplus components and read some hints to help ambitious RDFers build their own. You may not be able to make an exact duplicate but you can achieve the same results using hardware that's readily available, plus your own ingenuity.

It's Not Covert

JaMi supports his six-element quad with an A-frame almost three feet high (see Photo A). The frame sits atop a bicycle rack that is firmly attached to the rain gutter. Pillow blocks hold the 3/4-inch o.d. mast in two places, 21 inches apart, with the drive mechanism in between (see Photo B). The AC gearmotor turns at 72 rpm, coupled with a 13-inch belt to the 40 RPM mast.

Parking garage clearance? No problem. The A-frame lowers to the rear on hinges (see Photo C). The whole assembly adds only about a foot of height to the vehicle when lowered. JaMi says he's eyeing worm gear drives to automate the raise-lower function, but it's manual for now.

KK6CU's display unit is a Tektronix Model 603 medical monitor. It writes traces on the screen continuously until the ERASE button is pressed. When evaluating a storage oscilloscope for use in this application, look for external inputs on both left-right (x) and up-down (y) axes. Amplifiers for both axes must work at DC and have the same scale factors (volts per division).

JaMi uses a DC-to-AC inverter to power the CRT monitor, the motor, and a +/-15 volt DC power supply for the interface circuit. His 400-watt Tripp Lite square-wave inverter is not recommended for inductive motor loads, but the 50-watt motor and the 125-watt monitor have worked fine with it so far.

Electronic Trigonometry

A beam and receiver S-meter give signal strength information as a function of pointing direction (azimuth). This data is in "polar" form. You may remember from a math class that polar coordinates are represented by an angle (signified by the Greek letter theta) and the radius (r). The magnitude of r is proportional to signal strength.

To display polar data on an oscilloscope monitor, it must be converted to x and y axis voltages. The value of x equals r times the cosine of theta. The value of y equals r times the sine of theta. That means we need a device that outputs voltages proportional to the sine and cosine of the beam pointing angle.

Such a device exists: the sine-cosine potentiometer. You won't find one at your local parts store because they are used only in specialized applications such as servomechanisms and robotics. But try nearby surplus outlets—you might get lucky. JaMi found a good one for less than a dollar.

These pots have special windings that generate voltages proportional to the sine and cosine of the shaft angle when the pot is connected to equal positive and negative voltages. Several models are available from Servo Systems Corporation, 115 Main Road, PO Box 97, Montville NJ 07045-9299; telephone:

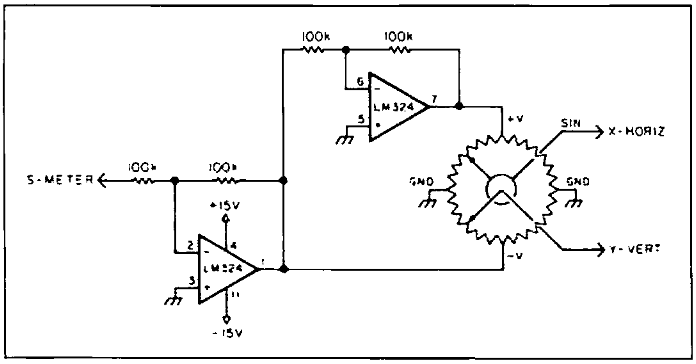


Figure 1. Basic polar-to-rectangular converter and pattern generator. The sine-cosine pot is shown as a bridge of four resistive sections and two wipers, but most units actually have a single tapped winding on a square board inside.

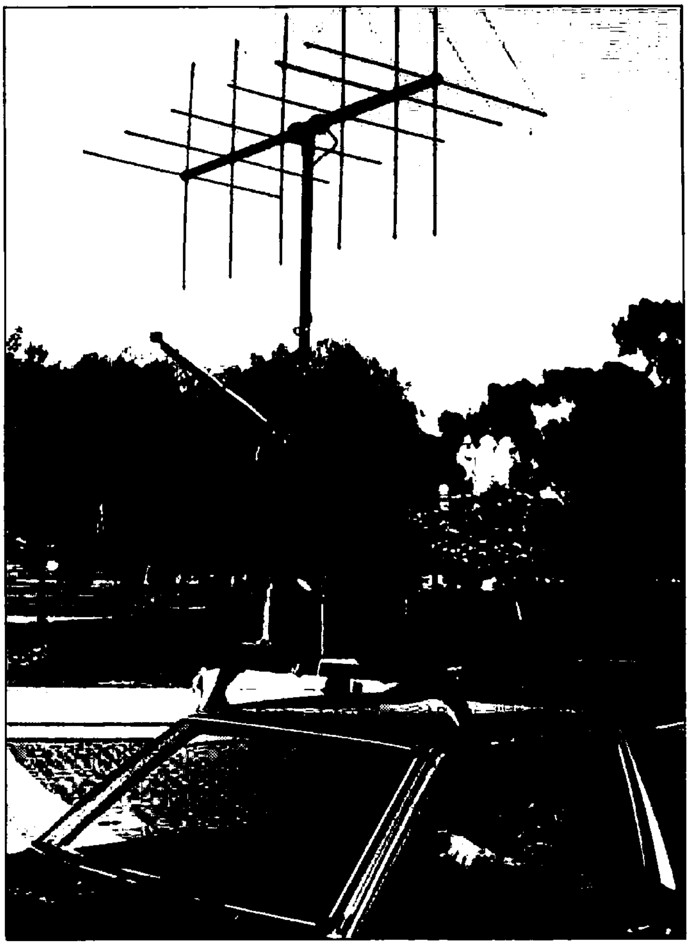


Photo A. Heads turn when JaMi Smith KK6CU goes on foxhunts with this array. It spins at 40 RPM and displays bearings on a storage oscilloscope.

(201) 335-1007, for a catalog. Prices range from $18.50 to $69.50 each. The minimum order is $30.

If you can do so without damaging it, peek inside your sine-cosine pot to see if it is designed for rotation in a specific direction. Some units have the wiper arm configured to "pull" across the winding in one direction. If you rotate in the opposite direction, the wiper "pushes" across the winding and the pot will wear out quickly.

Use care mounting the pot on your antenna mast, particularly if it has a 1/8-inch diameter shaft. Allow a little side-to-side play so that damaging shear force is not applied to the shaft. But don't allow much rotational play, as that will cause bearing errors. JaMi supports the pot by the wiring harness, as shown in Photo D.

Figure 1 shows the polar to x-y conversion schematic. The op-amps operate near DC, so compensation is not critical. A 1458 dual op amp (RS 276-038) should work fine. JaMi used two sections of an LM324C (RS 276-1711).

Each stage inverts the S-meter output, so equal but opposite polarity "r" voltages are applied to the sine-cosine pot windings. Using two identical inverter stages assures symmetrical low impedance drive.

On the pot JaMi used, a Computer Instruments Company model 106-1, one inverter output goes to pin 1 and the other to pin 2. Sine and cosine outputs are pins 3 and 4. Two pins on this pot (5 and 6) are connected to signal ground. Yours may have only one ground pin, or it might have two separate sections, one for sine and one for cosine.

The S-meter input level and the gain of U1a are such that Jami gets full-size scope patterns with signals that barely move the receiver's S-meter. As he approaches the T and the traces go off the scope face, he adds RF attenuation between the antenna and the receiver to shrink the pattern.

A Cheap Joint

The next dilemma is getting the signal from the spinning antenna to the stationary receiver with minimum loss. Prices for coaxial rotary couplers (sometimes called "rotary joints") start at a budget-busting $450 each at specialty coax product suppliers like Pasternack Enterprises. Furthermore, they must be mounted to the bottom end of the mast, which is where the sine-cosine pot also needs to go.

KK6CU's solution was to make an in-line rotary coupler out of a two-element continuous-turning potentiometer. Two elements are needed because an insulated slip ring is required for the coax shield as well as for the center conductor. If you take the easy route and try to couple the shield through the bearing of the pot, you'll have a very noisy system.

It's simplest to convert a pot having a 1/4-inch diameter shaft. "Most continuous-turn pots, including this one, have

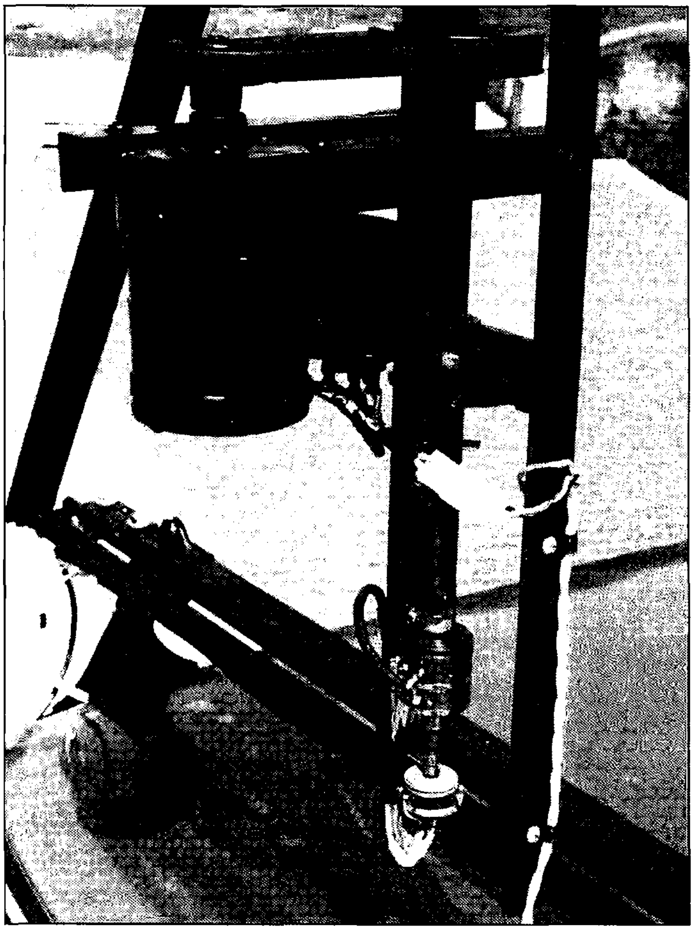


Photo B. A gearmotor and belt drive the mast, which rotates on two pillow block mounts. The antenna coax goes down the inside of the new brass shaft of the rotary coupler, located between the pulley and the sine-cosine pot.

Photo C. JaMi can fold the entire antenna assembly down on the car top for low-clearance situations.

some kind of insulated slip ring assembly bonded to the shaft," JaMi says. "I carefully disassembled it and put the shaft in a vise. Then I took a scribe and a little mallet and very gently chipped away the epoxy so that I could remove the two slip rings and their insulators intact from the shaft, which is discarded.

"I replaced the shaft with a piece of 1/4-inch o.d. hobby brass tubing, one foot long. I soldered a piece of 7/32-inch o.d. brass tubing inside the 1/4-inch tubing to reinforce it. I slid one of the slip rings on the tubing and bonded it in place; then I put the second one on, set for the same spacing as on the original shaft, and bonded it. The solderable connection points on the rings should face each other.

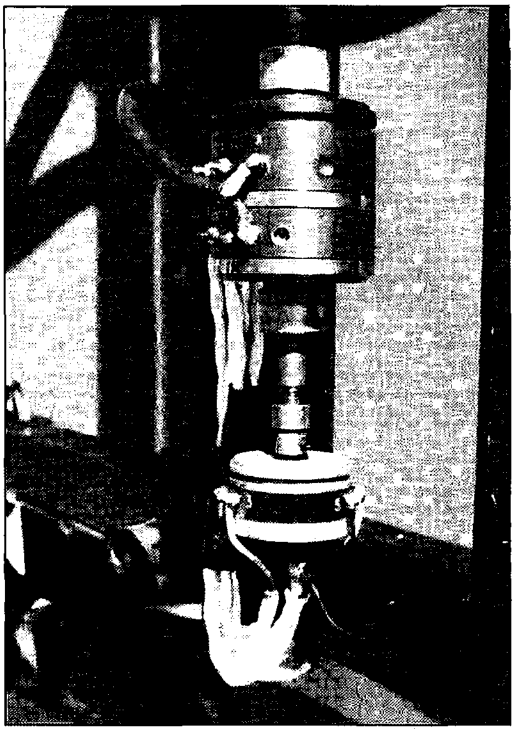


Photo D. Close-up of the two-stage pot modified into a coax rotary coupler (above) and the special sine-cosine pot (below) on the mast bottom.

"After the glue set up, I used a rat-tail file to gently make a little slot in the tubes (forming an oval) between the slip rings, then deburred it. The coax from the antenna comes down the mast, into this tube, and out to the slip rings. Despite the higher loss, I recommend RG-178 teflon-dielectric coax. You can use RG-174 if you're very careful not to overheat it.

"By cutting a square end on the coax and curling it just a tiny bit, I could feed the coax down the hollow shaft and out through the oval hole. Then I stripped the shield and center conductor in the normal manner and soldered them to the slip ring rotors.

"I removed the windings to minimize stray capacitance. Finally, I reassembled the pot, making sure that the coax pigtails didn't protrude and interfere with anything inside the enclosure. The stationary coax connections (RG-58) go to the rotor terminals of two stages, as shown in the photo."

JaMi has some additional suggestions for anyone duplicating this conversion: "The original shaft probably had one or more C-rings to hold it in place. You may have to stack washers or shims onto the hollow brass shaft to maintain proper spacing and avoid end play.

"Lubricate the wiper to prevent noise and avoid excessive wear," he adds. "You'll need to re-lube it occasionally, so drill a 1/16-inch hole in the body. You can spray tuner lube through the hole as needed. The hole should be located where it will not allow easy water entry."

Safety First

When constructing and using an RDF system like this, keep safety in mind at all times. Use extra care in designing and building your motorized antenna. Mount the beam high enough that it can't strike someone standing next to the car. Fasten the frame securely to the vehicle—suction cups aren't good enough.

Pay close attention to balance, distribution of weight, and center of gravity. An antenna that breaks up or sheds pieces on the highway could injure someone following, or cause a serious accident. JaMi says he arranged for someone to serve as a spotter, trailing his car during initial tests to watch for mechanical instability in the antenna system.

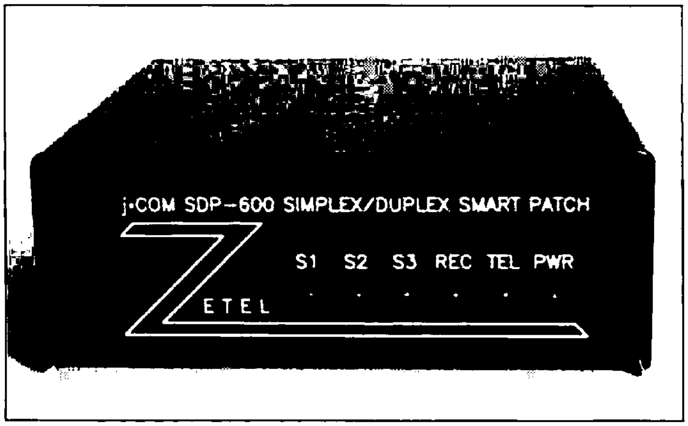
There is also potential danger in the 120 volt AC power system. Carefully ground the chassis of the storage monitor and all other equipment to the vehicle frame. Do not leave AC terminals on the motor, or any other equipment exposed. Cover or tape them up. Don't use the system in wet weather unless you have a waterproof cover for the motor and other exposed AC-operated items.

A good engineer is never content with his or her creations. KK6CU is no exception; he's trying out new bells and whistles constantly. He has incorporated the x and y outputs from a Radio Shack fluxgate compass sensor through a switch to put a "north dot" on the CRT screen. When his rotatable screen-mounted protractor is aligned with the north dot, bearings are relative to north instead of relative to vehicle heading. He is working on new offset circuits to subtract the noise floor from the scope trace.

JaMi and I welcome your letters with questions on this unusual RDF scheme, but please enclose a self-addressed stamped envelope if you want a personal reply. 73

NEW PRODUCTS

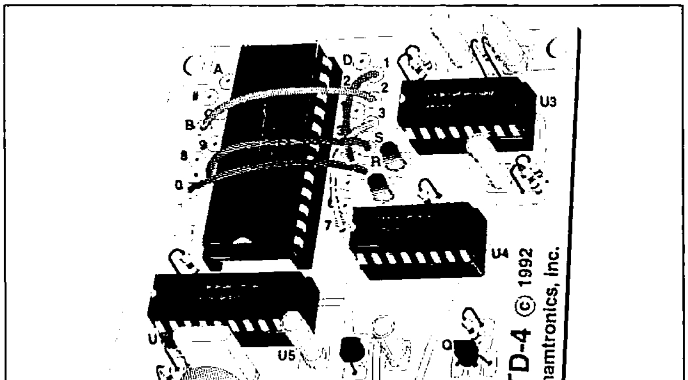
Compiled by Hope Currier



j•COM

The Model SDP-600 autopatch from j•Com is a low cost microprocessor-controlled interface between a VHF/UHF transceiver and a telephone line, allowing the user to make and receive telephone calls from any HT or mobile rig within range of the base station. Installation consists of connecting the autopatch to the rig's microphone and speaker jacks and plugging in an RJ-11 telephone jack. Control and programming of the autopatch is done by DTMF tones issued from the remote. Separate user-programmable access password codes can be set up for local and long distance dialing. And, unlike other low cost autopatches, the SDP-600 can be used in full duplex mode with a dual-band transceiver, so both parties can hear each other at the same time. Simplex mode can also be used. With the reverse patch option enabled, incoming calls will cause a short ring-out over the air and the user can then answer the call using his access password code.

The SDP-600's introductory price is $199.95. Contact *j•Com, Box 194, Ben Lomond CA 95005; (408) 335-9120; Fax: (408) 335-9121.* Or circle Reader Service No. 201.



HAMTRONICS

The TD-4 Selective Calling Module from Hamtronics is an economy touchtone decoder with one latching output. This versatile module is primarily designed to mute the speaker of a receiver or transceiver until someone calls by sending four-digit DTMF signal, thus making it unnecessary to listen to all the activity on a channel just so someone can call you once in awhile. The TD-4 also may be used to turn on an autopatch or other device which requires a simple ground to activate it. The four-digit DTMF address is easily set in the field with wire jumpers. The 2-3/4-inch-square PC board is easily packaged for custom installations, and it operates on 12 VDC.

The TD-4 is $49 in kit form or $89 wired and tested. For more information or a complete catalog, which also includes all Hamtronics' VHF/UHF transmitters, receivers, repeaters, converters, preamps and accessories, contact *Hamtronics, Inc., 65-E Moul Rd., Hilton NY 14468-9535; (716) 392-9430, Fax: (716) 392-9420.* Or circle Reader Service No. 206.

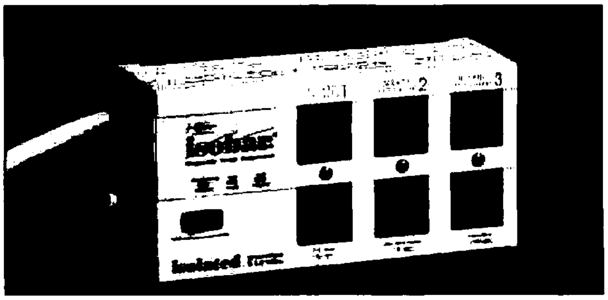
INTERFLEX SYSTEMS

InterFlex Systems has released the KaGOLD DualPort for Kantronics TNCs, the KAM and all KPC units; and PkGOLD Enhanced for AEA TNCs. KaGOLD fully supports dual-port operation, mixed modes including AMTOR, RTTY, CW and packet. Three file transfer methods are supported, including remote send/receive as well as text files and brag files. The packet conference bridge is easy to use and supports multi-level conferences and cross-port conferences on two port units, useful for nets, emergencies and group discussions. The built-in logging feature also handles automatic exchange of name, QTH and QSL information with other GOLD users, and many more advanced features. Instead of fixed-length buffers, PkGOLD and KaGOLD support huge scrollback buffers that are dynamically allocated (memory given to activities that need it), with up to 250K of scrollback on most systems. They have fast installation and startup and run in Host Mode for high performance. The built-in Clipboard editor's cut/paste feature makes traffic handling and message storage and retrieval a snap. Both come with a 95-page bound manual, an extensive online help system for all parameters and operating modes, and a quick reference guide.

Each program is $79.95 plus shipping and handling. For more information, contact *InterFlex Systems, P.O. Box 6418, Laguna Niguel CA 92607; (714) 496-6639; Fax: (714) 496-8041.* Or circle Reader Service No. 202.

EUR-AM ELECTRONICS

EUR-AM electronics is offering an adjustable mount (up to 25 degrees) for PL or N type connector antennas (like Diamond, COMET, etc.). The mount is currently imported from WiMo (Germany) and comes with 12 feet of RG-58 coax permanently connected in either vertical (fenders) or horizontal (roof) fashion. The N type is $36; the PL type is $33. For more information, contact *EUR-AM Electronics, P.O. Box 990, Meredith NH 03253-0090; Fax: (408) 866-4311.* Or circle Reader Service No. 203.



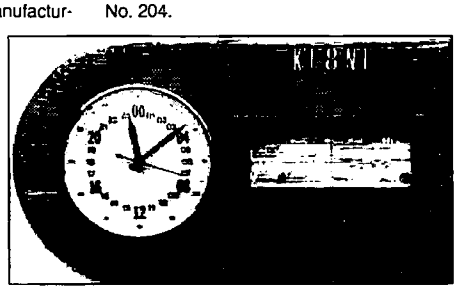
TRIPP LITE

The new ISOBAR(R) Ultra surge suppressor from Tripp Lite has a revolutionary new design, featuring diagnostic indicators and a new comprehensive warranty. Using multicolored indicator lights, the ISOBAR Ultra can detect and display wiring faults, loss of power and integrity of the surge protection circuitry, alerting the user to problems *before* equipment is turned on. This series also features new Lifetime Ultimate® Insurance, which guarantees every Ultra model and the connected equipment against surge damage (including direct lightning strikes) for life, up to $25,000. If surge damage occurs, the ISOBAR Ultra and connected equipment will be repaired or replaced free.

Each ISOBAR Ultra also features exclusive isolated filter banks to prevent interference between connected components, two or three UL listings, multiple filtering components and a rugged all-metal case. They are available in 4-, 6- and 8-outlet models, with optional fax/modem protection. For prices and more information, contact *Tripp Lite, 500 N. Orleans, Chicago IL 60610-4188; (312) 329-1777, Fax: (312) 644-6505.* Or circle Reader Service No. 205.

MIDWEST WOOD PRODUCTS

Midwest Wood Products has introduced a new clock made of solid oak and measuring 10-3/4" by 19". It comes with a frame for either size U.S. license and has non-glare lenses for both the movement and display frames. The quartz movement is U.S.-made, runs on one AA battery, and is warranted by the manufacturer for six years. The wood and display frames are warranted for one year. The letters on the clock are self-adhesive and are easily changed if you upgrade or move and change your callsign—the necessary letters and numbers will be supplied for $1. The hardware is brass, including the bezel, and the clock is available with a natural finish or stained, and has a polyurethane finish.



This clock is available in a 12-hour or 24-hour version for $69.95 plus shipping. For more information and/or a complete catalog, contact *Midwest Wood Products, 16141 24th Ave., Coopersville MI 49404; (616) 677-3706.* Or circle Reader Service No. 204.

Number 11 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8-1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Bullet Electronics marketed several kits in the late '70's; among these were "Grandfathers Clock" and "Super Music Machine." Construction instructions and schematics are desperately needed. Will pay. *Jack Christilaw KO8I, 38700 Ann Arbor Trail, Livonia MI 48150.*

Wanted: Tube schematic for 3RP1 CRT. Also, schematic suggestions for building a simple o'scope using this CRT. Please send info by air mail. *David K. Hanson KBØEVM, SAUDIA, P.O. Box 167 Cost Center 956, Jeddah 21231, Saudi Arabia.*

Number 12 on your Feedback card

73 Review

by Larry R. Antonuk WB9RRT

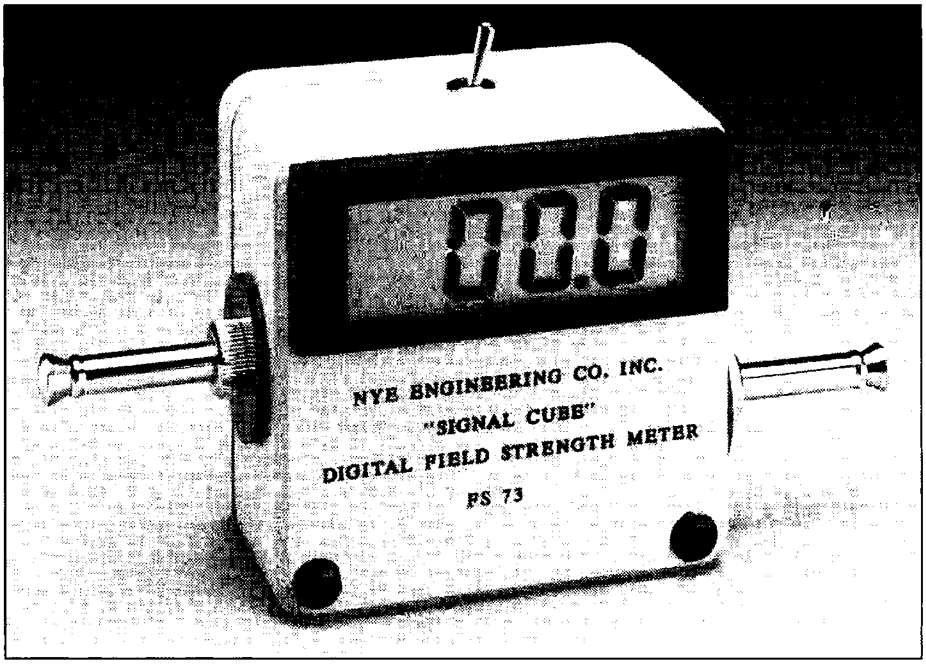
Nye Engineering
4020 Gait Ocean Dr. #606
Fort Lauderdale FL 33308
Telephone: (305) 566-3997;
Fax: (305) 537-3534.
Price Class: $159

The FS 73 Signal Cube™ Digital Field Strength Meter

Measure both absolute and relative field strengths.

Forward and reflected power measured at the transmitter can tell you quite a bit, but not always the whole story. You may have a VSWR of 1.1:1, and 250 watts out, but for some reason you're just not making the trip. What's the problem? It's obvious that what's going into the coax isn't getting out of the antenna. The flat VSWR is just there to fool you—it could be caused by several different problems. You may have moisture in a connector at the antenna that just happens to approximate 50 ohms. Your receive signal may be fine, since the connector may not break down until it sees the high power transmit signal. You may have had moisture in the connector last year, and by this year the moisture has crept down the coax, causing it to become very lossy—not unlike a 50-foot-long resistor. At any rate, you begin to wonder why people no longer talk to you, even though your trusty wattmeter tells you that everything's OK.

At times like this, the tool to pull out of your bag is your field strength meter. Short of a QSL card, the only way to really measure the effectiveness of an antenna system is to measure the field strength produced by the antenna—how much signal is actually being thrown off into the ether by that tangle of wires on the roof. Basic field strength meters consist of a small antenna, a diode and capacitor to rectify the RF, and a DC meter to display the level. These meters are useful only for relative readings, and tend to be somewhat lacking in the sensitivity department. (In technical circles, they are referred to as being "deaf as a post.")



The Nye Engineering FS 73 Signal Cube digital field strength meter.

The Signal Cube

Enter the "Signal Cube" field strength meter from Nye Engineering. The Nye Engineering folks have mixed some traditional field strength meter values with some new technology, and have come up with a winner. The first traditional value you'll notice is the quality. Built into a 2.5" x 2.5" x 2"-deep cast aluminum box, the unit is as solid as a rock. Another quality feature is the unit's practicality—it makes relative as well as absolute measurements, from 100 kHz to 450 MHz. The Signal Cube is splashproof (coffee??) and has a range of 30 mV/meter to 30 V/meter. It's autoranging, and wideband—the only control available is the on/off switch. A large 3-1/2-digit display brings the device into the 20th century, making it easy-to-read and accurate, and giving it a rather high-tech look. Two collapsible antennas pull out from each side of the Cube, making a dipole that can be adjusted to different lengths to change the sensitivity of the meter.

Measurements

The addition of absolute measurements to a meter of this caliber is quite an achievement. For those unfamiliar with the concept, an absolute field strength measurement is one that is related to a given reference—in this case, the number of volts/meter, derived from the voltage impressed upon the two antennas. In actual operation of the Signal Cube, this value is calculated by taking a reading from the display, and using a chart (found on the back of the unit or on the instruction sheet) to relate the reading to the frequency of operation and the lengths of the small collapsible antennas, producing a value in volts/meter. On the other hand, a relative reading is simply one related to a previous reading. The actual value is not of interest—we only care if the second reading is better or worse than the first.

To put things in perspective, relative readings would be used to tune a transmitter. Your only concern would be to watch your voltage and current readings, and tune for a maximum indication on the Signal Cube. It wouldn't matter what the readings were, just so you got the peak reading possible on the Cube. Absolute readings would be useful to measure the performance of, say, a 2m yagi antenna you just built. You could set the unit up to transmit in the open, then take readings a fixed distance away at several points of the compass. This information could be used to plot a basic directivity graph. You could then change the design and re-measure, or perhaps compare a commercial antenna to your design. (Commercial test ranges often keep the field strength meter stationary and rotate the antenna, but building a commercial test range is beyond the scope of this article.) Closer to home, you might record readings from your HF antenna at several key spots around town while your buddy keys it up. Once a year or so you might repeat the exercise, and get a jump on things the next time you get that water in the connector!

Other Uses

Of course, once you get your hands on the Signal Cube the uses for it multiply. In addition to the traditional applications, you can use the Cube to measure the levels of RF floating around the shack itself, perhaps caused by faulty antennas, or maybe poorly shielded equipment. The Cube can be used to tune a ground lead, artificial ground, or an antenna counterpoise. Paranoid users will find it useful at work—the high sensitivity of the Signal Cube makes it useful for ferreting out those hidden transmitters bugging your office. How much RF is coming out of your microwave oven? How about the cellular phone on your front seat? How about that color computer monitor?

These last three examples are all "out of range" of the FS 73, either below or above the 100 kHz to 450 MHz range, but they still produce usable readings on the instrument. They just can't be converted to absolute field strength readings. The readings are still useful from a relative basis, however. For instance, what's the best position of this computer monitor EMI shield, in order to reduce the amount of RF bombarding my cranium?

Operation

Operation of the Signal Cube could only be simpler if it had an auto-sensing on/off switch! You simply turn the unit on and read the display. The display blanks in the event of excessive input—simply collapse the antennas, or increase the distance to the transmitter. The two antennas form a dipole, so there is some directivity to the unit. For most situations, the Cube is just rotated to give the highest reading, which is theń noted.

This directivity and the high sensitivity make the Cube of some interest to the foxhunter, especially during the end game. However, the FS 73 lacks an external antenna jack, which might be used to connect a higher-gain, more directional antenna than would be necessary in most foxhunts. In addition, the LCD readout, while quite readable, has no bar graph—it's designed mainly for measurements, rather than peaks or dips.

Most of us aren't too familiar with field strength measurements, but the sensitivity of 30 millivolts per meter is quite good. Translating this to reality, it means you can pick up a 1 watt, 440 MHz handheld at about 150 feet. Holding the Cube in your hand tends to distort the pattern, so two tapped holes are provided to attach your own non-conducting pole.

The FS 73 Signal Cube is a great tool for antenna experts, and for anyone who's interested in finding out where the invisible (and sometimes insidious) RF is in his or her life. Far from being a specialized instrument, you'll find more and more uses for it on a daily basis. ■

Ham Television

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High-Flying ATV in Utah

Quite a few groups have sent up ATV-equipped high-altitude balloon experiments this past year. One of the more prolific (and ambitious) groups is the Bridgerland Amateur Radio Club in Logan, Utah. Over the past year BARC has flown nine balloon experiments (two were tethered) carrying amateur radio equipment. Every payload on these flights has been successfully recovered. These initial flights carried a two-channel Radio Shack VHF receiver, a 250 milliwatt 2 meter beacon and a tone decoder that would activate a release mechanism on command from the ground. The early flights used a standard rubber weather balloon that burst immediately upon reaching maximum altitude. The seventh and eighth flight used a special *zero-pressure* balloon (made out of a plastic film) that could allow the payload to float at peak altitude for as long as a day.

These initial flights helped give the group the know-how and experience to design payloads to withstand the extremes of the upper atmosphere, launch large delicate (and expensive) balloons and the ability to successfully track down and recover the payloads wherever they landed (usually in remote and rugged terrain) using direction-finding equipment. The following is an account of their latest effort (the ninth flight), as described by Harl Goodsell W7LTH.

The Super ATV Balloon

The BARC group decided to attempt a flight using a newly designed *super-pressure* balloon donated to them by Winzen International, Inc., makers of large high-altitude balloons and recovery parachutes. A super-pressure balloon is designed to go to a fixed altitude and remain there for long periods of time. It is conceivable that it could remain at altitude for months, traveling thousands of miles in the jet streams. *[Ed. Note: Imagine an ATV (or voice) repeater at 65,000 feet periodically floating across the country! Two-way contacts over 600 miles apart could be reliably established with P5 pictures from such a system.]*

Photo A. Inflating the zero-pressure balloon for payload test flight #8. Photo by Gil Moore N7YTK.

Photo B. Liftoff of flight #7 using a zero-pressure balloon. Photo by Harl Goodsell W7LTH.

The BARC Program

One of the goals of this program is to interest high school and university students in science by flying their experiments as part of a balloon payload. This allows them to see the results in real-time as the flight progresses.

The fifth flight carried the first of these student experiments: a solar-driven motor that could be used for maintaining a device in relation to the sun. The sixth flight carried several hundred paper gliders that were released at about 2,000 feet as part of a Cub Scout event. The glider that went the farthest received a prize.

Gil Moore N7YTK, Adjunct Professor of Physics at Utah State University and a representative of the Rocky Mountain NASA Space Grant Consortium, has been the driving force behind these balloon flights. He has been able to obtain the special balloons and has also helped with many of the expenses incurred. Many of the local hams have put in long hours designing, building and testing the circuits used in the payloads.

During a conference on balloons, Gil met the folks from Winzen and showed them a videotape of the BARC experiments. He was asked if the BARC group would like to fly one of their newly designed super-pressure balloons. They even offered to come out and show them how to handle this special very thin clear nylon material. As Gil later put it, "I just couldn't say no."

The Payload

One of the goals was to have ATV on board and to have a means of sending real-time and delayed information down from the payload. Stan Wellard N7UXC took over as project coordinator and the new payload started to come together. It contained a Motorola P50 2 meter FM radio, a tone decoder board, a Campbell Scientific data-logger, a P.C. Electronics KPA-5 one-watt ATV transmitter on 434 MHz, an Olde Antenna Labs "mini-wheel," a Micro Video Products miniature black and white CCD camera and a High Technology Flight video overlay board for the callsign ID (N7YTK). A three-inch front surface mirror was mounted at a 45 degree angle in front of the TV camera and rotated by command using a one-RPM motor to allow a full 360 degree view. A PacComm UMPAD-4 micro powered TNC sent down packet telemetry on 144.290 MHz via the Motorola 2 meter FM HT. Kelly Vining KE7WI built a separate 250 milliwatt beacon transmitter that IDed for 20 seconds every three minutes on 145.550 MHz to aid in tracking the balloon.

There were sensors to measure inside and outside temperature, as well as battery condition. There was a Magellan GPS (Global Positioning System) receiver board that would give the bal-

Photo C. Stan Wellard N7UXC (r) checks out the payload for the super-pressure balloon experiment (flight #9). The rotating TV mirror system is on the left and the GPS antenna (egg-shaped) is shown sticking out on the right side of the payload. The radiometer is located inside with the rest of the electronics. Photo by Hart W7LTH.

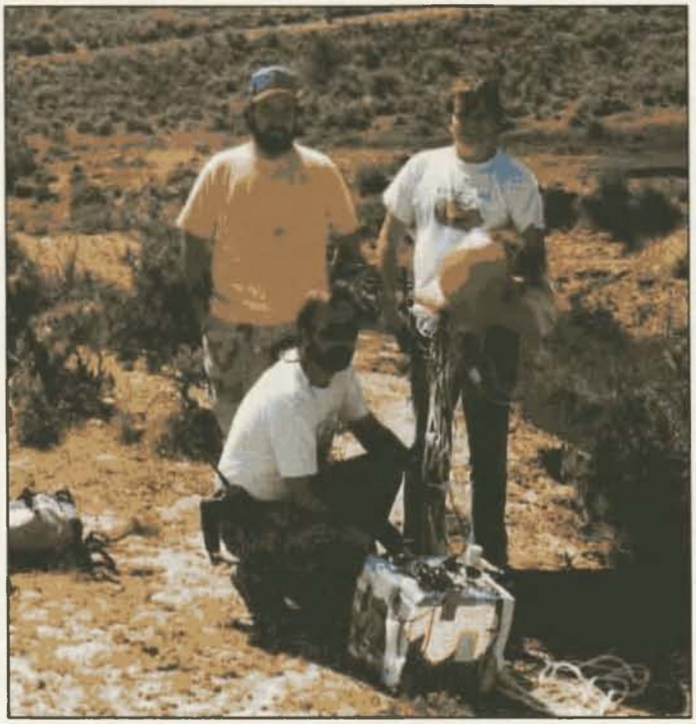

Photo D. The super-pressure balloon payload (flight #9) is found just eight miles northeast of Evanston, Wyoming. (l to r): Jeff N7UWW, Mike KG7FZ and Mark N7EVJ. Photo by N7UWX.

loon's current position to within 300 meters (latitude, longitude and the altitude). A four-channel radiometer was obtained to study the ozone layer. The data logger stored data from the radiometer, sensors and the GPS receiver and downlinked the information via packet on 144.290 MHz on command or automatically at two-minute intervals. The first three packets gave the GPS position data and the fourth packet gave the sensor data.

A cutdown system consists of two electric pyro igniters controlled via the tone decoder. On activation, it would burn a large "V" in the top of the balloon and also sever the line holding the payload with its 12-foot parachute. There was also a fail-safe timer just in case all else failed. The payload weighed in at just over 27 pounds. *[Ed. Note: A payload of this size requires a special FAA waiver (four to six pounds is the limit for free-flight balloon payloads unless a waiver is issued)].* In addition, two strobe lights were on the system since the balloon would be launched during darkness. The payload was encased in a rigid nylon framework about 12 inches square and covered with 3/4-inch styrofoam with an outside layer of metallized mylar to act as a radar reflector. There were three separate battery supplies used to power different parts of the payload.

This super-pressure balloon when fully inflated has a 26-foot diameter and a volume of 9203 cubic feet. It can carry a 30-pound payload to 64,000 feet. Once there it could stay at that altitude for weeks or months.

The Flight

Early on the morning of August 1st, Gil N7YTK called the FAA from his cellular phone and received clearance for liftoff. At exactly 4:00 a.m. local time the balloon was released. It began slowly moving to the north but was NOT rising! It turned out that the payload weight had been miscalculated and not enough helium had been pumped into the balloon. The balloon was quickly captured and brought back to the launch site for some additional helium. At 4:07 a.m. the balloon was again on its way and finally began its journey.

The launch was planned for this early hour so that the radiometer could look at the ozone layer as the sun came over the horizon. Also, one of the goals was to see how the new super-pressure balloon would react when the sun hit it and expanded the helium to stretch the balloon skin tight. ATV was used to observe the balloon as it reached its maximum tautness and to see if the cutdown system functioned properly and the parachute deployed.

All systems performed well with good data coming down on the packet downlink as reported by AC7O in Clayton and Dan KAØEOF at their portable stations. Joe N7NJR was receiving the ATV picture (with some snow) and Brian N7QAR and Dick K6KCY were busy sending commands to downlink the data and turn on and rotate the TV camera mirror. Members of the chase team, Mark N7EVJ, DeAnn KB7LLG, Mike KG7FZ (and his brother Jeff N7UWW), all headed out to the projected landing site. Kevin N7RXE and Tyler N7UWX headed for the top of an 8,000 foot pass that was halfway to the landing zone. Gil and Stan updated the aircraft map as the GPS position data came in and helped steer the crew in the right direction. At daylight Hugh N7KW took off from the Logan airport followed by a second plane piloted by Carl Howlett with Jamie N7XLH riding along as observer.

The balloon stopped at 45,000 feet and remained at that altitude. A look at it with the ATV camera revealed that it was not completely in the sunlight yet and had not fully expanded. Reception reports came in as far away as Kemmer, Wyoming. In addition, N7PQZ in Rawlins, Wyoming, had over an hour of packet hardcopy. At about 7:15 a.m. the sun shown fully on the balloon and within minutes it rose to its peak altitude of 64,000 feet and held steady. The ATV picture revealed the balloon was now fully expanded. Brian N7QAR issued the cutdown command and a cheer went up as the ATV downlink displayed the parachute blossoming out above the payload.

Recovery

After the payload landed, the chase crew closed in on the landing site near the town of Evanston, Wyoming (75 miles from the launch site). As the recovery team drove down a dirt road they came to a fence that had a sign reading "No Trespassing—Hunter Control Area. Cyanide Poison Charges Set." Since the signals were so strong, they knew the package was just over the next rise.

After a call to the local Sheriff, the recovery team was escorted through the area and quickly found the payload and parachute in good shape. The balloon envelope was even found just two miles away by Randal N7YSV and SDL employees while riding in the Space Dynamic Laboratory/USU recovery truck.

The actual landing site was within a mile of the prediction as given by Stan from updated data. The flight had lasted three hours and 50 minutes. The total time from liftoff to recovery took six hours and 47 minutes. The radiometer data is currently being analyzed and appears to valid.

Over 25 hams, and many more who were monitoring, were involved in this very successful flight.

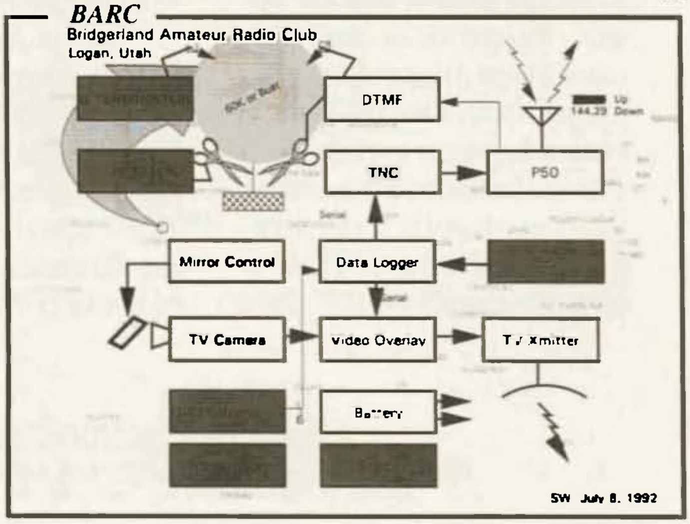

Figure 1. Block diagram of the BARC payload. Drawing by Stan Wellard N7UXC.

ABOVE & BEYOND

VHF and Above Operation

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Filters for Amateur Use

Last month I briefly discussed 10 GHz Gunn oscillators and the components used with WBFM systems. This month I would like to get into another subject altogether: different RF filters and coaxial and waveguide systems. I have accumulated questions from readers on this topic for quite a while. These questions vary from problems on very low frequencies (60 kHz) to very high up into the microwave spectrum.

I usually orient each of my columns to some of the topics brought up in letters I receive from our readers. I feel that this is the best way to present material of interest. I appreciate your feedback on these and similar topics. Most specific questions invoke a more general discussion of applications and materials that can benefit our amateur endeavors. Sharing the information has always been paramount to me.

Transmission Paths

Let's start off with a simple premise. "Why don't we move some of our radio-based systems to a closed coaxial or waveguide environment? In that way we would reduce quite a bit of interference and congestion on much of our frequency spectrum." I think this question has been asked in various ways ever since spark ran king. Why don't we use coax or waveguide to contain communications paths instead of using atmospheric-type transmission paths?

Before we get far afield, let me say that we don't use coaxial cable or waveguide for systems covering great distances because the cable losses become too large to pass signals as the distance gets greater and greater. Loss in the atmosphere is great also but nowhere near the loss encountered in coaxial systems. Antennas perform better in transmitting and receiving energy at very great distances.

Filters also enter into a major aspect of our lives: They help to separate the multitude of signals and help prevent overload in some of the very simple systems. Additionally, filters can be used to prevent out-of-band image product signals from reaching the antenna when mixing low frequency IFs for 144 MHz or 432 MHz. Of course, we want the desired frequency signal to pass and the filler does just that.

The trend for advancement in communications has brought along a corresponding reduction in bandwidth and improvement in signal-to-noise ratios due mainly to filters. There are other advanced wide-based systems employing spread spectrum and frequency hopping; I am not going to get into them here. Before we get on to several different filter types and discuss them, let's see how they help to solve part of the problem.

First, filters to me are the doorways of modern transceivers. By comparison, early receivers were wide open, consisting of only a detector, and would receive everything. It's just like a simple crystal detector or "potato" receiver—you receive everything that is strong in your area (a potato receiver is very similar to a crystal detector). The same analogy for low frequency is true for both our VHF/UHF and microwave bands.

For example, when you take an HT to a favorite overlook or mountaintop, why does your HT seem dead? Is your HT OK or is the band dead? Well, the band is not dead and your HT is OK. What is going on is that the same problem a simple crystal receiver experiences is happening to your HT, but in a slightly different manner. The HT is being desensitized by operating near a high power transmitter. Your HT's front end is shutting down due to the high power RF that is being thrust upon it. The cure for the HT is a low-pass filter that will pass 148 MHz with low loss and provide high loss at 150 MHz and higher. This will minimize the effect on your HT and allow normal operation to be restored, as attenuation is given the higher frequency RF as presented to your first stage amp in the receiver. The same would be true for other UHF frequency bands.

On microwave the problems are the same. Fillers can be used to minimize out-of-band influence and aid operation. With basic systems operating wideband FM (WBFM), the addition of filters would not be of much use but would be rather cumbersome to the basic systems. The basic systems provide enjoyment and easy contacts. While they could be modified, I feel that a point is reached where refinements do not give apportioned results for the effort put forth. When you have reached this point, as I did some time ago, the necessary switch to a reduced bandwidth and mode of transmission would yield higher efficiency of operation—for starters, reducing bandwidth improved operation several orders of magnitude. Changing from FM to single sideband with less than 3 kHz bandwidth also made improvements. Fillers again play an important part in the series of improvements in circuit performance and operating practices.

Types of Filters

This month I will describe a few new types of filters and discuss some of the methods and materials used to construct them. The first filter is one that was designed by Chip Angle and presented quite a few years ago for 1296 MHz. Basically, it's a copper pipe 3" in diameter and 2-1/2" long. See Figure 1 for details. The filter is constructed with a 7/8" copper section fixed to the top lid of the cavity. Two coupling links are soldered to this 7/8" pipe section, directly to the center pipe section 0.600" up from ground. These coupling links are 180 degrees apart from each other and connected to their respective input/output coaxial connector, type "N" in this case. The bottom of the cavity, also made out of 1/8" brass like the top section, has a tuning screw that will tune the cavity and the 7/8" pipe section to resonance.

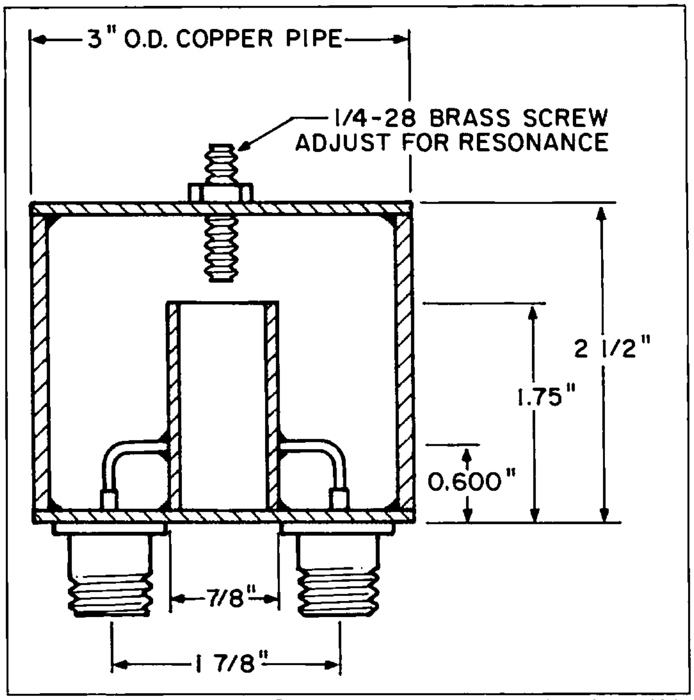

Figure 1. 1296 MHz BPF by N6CA; 30 dB attenuation at 800 MHz and 1800 MHz, insertion loss is 0.05 dB.

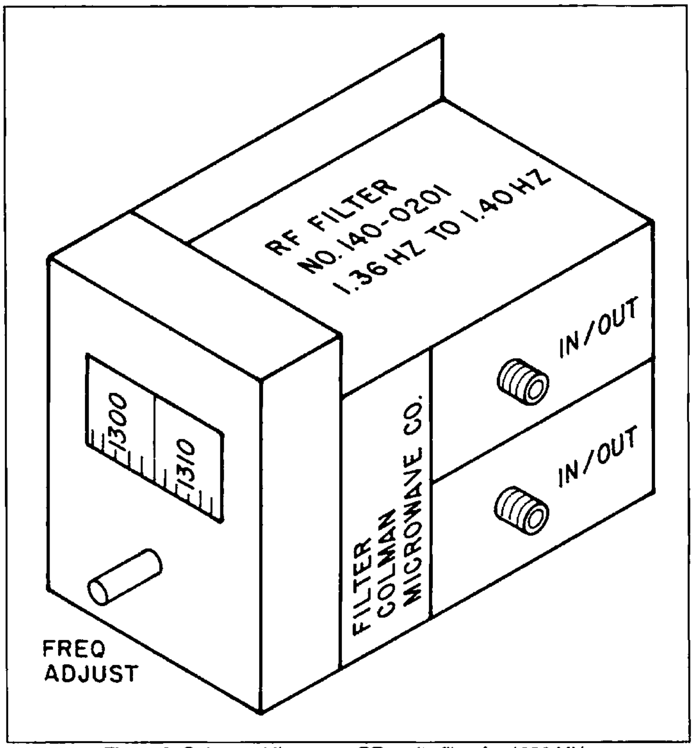

Figure 2. Coleman Microwave RF cavity filter for 1296 MHz.

The tuning screw is made out of 1/4" rod that is tapped 1/4-28 to thread into the bottom cavity plate. Provide a lock adjust to make the tuning tight but not bound up. Then, when the cavity final adjustment is made, you can lock the adjustment in. Typical specifications are 6 MHz bandpass, 30 dB isolation at 800 and 1800 MHz, insertion loss less than 0.05 dB, and return loss greater than 30 dB.

The construction of this filter is quite simple with hand tools and a little patience. Commercial filters can be obtained for this same range and one that I got came from the Coleman Microwave Co. of Lebanon, New Jersey. It's a tunable cavity adjustable from 1.3 to 1.4 GHz. I have just enough room to make 1296 MHz in its tuning range before the stops take effect. The filter has a window and film calibration setting knob controlled with 1 MHz calibration marks about 1/8" apart, with real easy frequency setting. See Figure 2, the Coleman cavity. These are available in surplus in multitudes of frequency ranges covering several hundred MHz to just about 6 GHz. Usually at the higher microwave frequencies, 12 GHz and up, the cavity designs stop and waveguide-based designs take over.

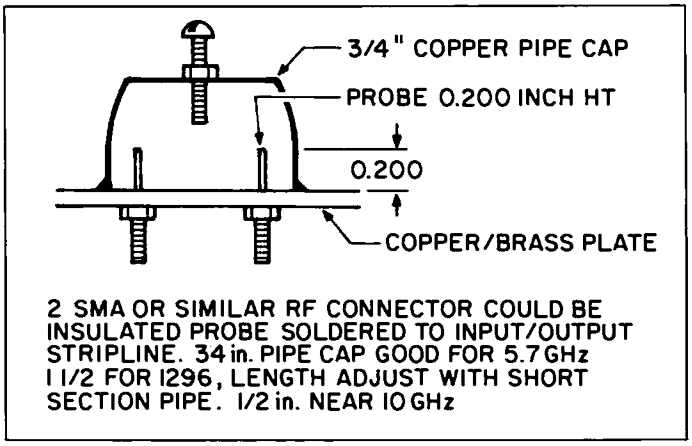

Figure 3. Pipe cap filters courtesy of WA5VJB @ North Texas Microwave Society.

Designs for filters that can be used in frequency ranges from 1296 MHz to 6 GHz can come from unusual materials. Reports of filters from Kent WA5VJB show that pipe caps for copper pipe can be selected to size and inverted and fitted with an adjust screw on the top of the cap. The cap is soldered to a copper or PC board material ground surface to which probes are added on the opposite side of the ground surface for input/output coupling. Filters of this nature have loss that is determined in part by probe length and spacing. These filters tend to exhibit a little excess loss but do work well from 2304 MHz to 6 GHz. This depends on the size of pipe cap: 3/4" for 6 GHz and 1-1/2" for 2304 MHz. See Figure 3 for details.

Waveguide Filters

Waveguide filter designs usually start at 5 GHz and work up in frequency, where they provide very high quality filters. A difficulty with them is that they require tightly controlled construction techniques because the dimensions are quite critical. I have not tried to construct one yet but when I do I will present this information and describe any troubles I encountered.

I have tried to re-adjust waveguide filters obtained from commercial sources to amateur bands. In both the 6 and 10 GHz waveguide filters I did not have very much success with retuning most filters when the designed frequency was over 500 MHz higher than where I wanted to use them. They did not have much frequency range in tuning or retuning. As they tuned downward they seemed to get balky and have high loss when lowering a 11.5 GHz waveguide filter to our 10 GHz band. I also encountered trouble in trying to lower in frequency 6 GHz filters to 5760 MHz. This did not work either. This is not to say it is all impossible, just that the filters I tried would not tune low enough to make them usable. My recommendation on waveguide filters is to stay away from them unless they are cut for your frequency or you make one yourself.

Interdigital Filters

There remain two basic types of filters to be covered: the interdigital filter and a more recent application of it, the hairpin filter. First the interdigital filter. This is the last of the "great block of metal" filters, or filters constructed out of or using substantial metal, forming a cavity. In their construction, fingers (quarter-wave sections) are interleaved and spaced with close coupling to allow the RF to flow through them, by nature of their resonance. A small adjust screw is positioned above the high impedance end of each finger to permit adjustment to the desired frequency. See Figure 4 for typical interdigital filter construction.

The size limits construction of this type filter from 400 MHz, or more typically 1300 MHz, to over 12 GHz in most commercial applications. A filter for 1300 MHz can measure 4" x 8". For 10 GHz, that equates to less than 2" long and 3/4" square for a six-element filter. These filters can be retuned quite far in frequency, namely 10% to 15%. For an 11 or 12 GHz filter it usually can be retuned to 10 GHz without too much difficulty.

The Hairpin Filter

Another type of filter that is becoming very popular is the hairpin filter. This is a printed circuit type of filter where each element of the filter, or hairpin, is a half-wavelength long. The actual length that can be constructed depends on what type of dielectric material it is constructed on, the velocity factor of the material, and what frequency you plan your filter for. Most filters of this type became very popular with the advent of the MMIC amplifier no-tune design for 1296 MHz and a variety of other frequencies. Printed circuit board fabrication of this type of filter demands that accurateness be tightly controlled or else the filter will be resonant off frequency, high or low, depending on the construction techniques. You can use math to a large degree, but be sure to add a little jiggling to make it fit your model, especially to hit a desired frequency without re-adjustment. Gremlins always seem to enter into the math stage and exact operation is not always proper. What I do with a particular PC board substrate is to have my stock "jiggling" or "fudge" factor to multiply by for each material to account for my particular construction techniques. This seems to work out OK. If you try some you will have to develop your own factor as it can vary quite a bit, depending on the board material you use.

A prime consideration when constructing these filters is what type of substrate you construct your filter on. For instance, the dielectric constant of the material has a lot to do with how large your filter will be. Low dielectric material like Teflon™ has a dielectric constant of 2.5 (E_r =2.5), and as such will produce larger filters than ceramic (E_r =10), where the filter's length will be quite a bit smaller. Well then, why did the PC board makers use G-10 epoxy when they designed these kits for their no-tune designs? Well, ceramic and Teflon PC board material is quite expensive and not a common everyday shop stock material. Board cost is quoted by the inch. However, high quality epoxy Fiberglas™ G-10 PC board material has a E_r =5 and is a good cost/performance alternative. (Note: The upper frequency for G-10 epoxy board is 3 GHz, where it gets lossy but is still reasonable.) While the Teflon and ceramic types have excellent RF loss factors and are highly recommended for microwave construction, the G-10 Fiberglas board shows good loss characteristics to 2 GHz. It gets a little bit of high loss near the top end of the frequency, but this problem is offset by the convenience of the easy availability of G-10 type PC board material. Teflon, and especially ceramic materials, are a lot more difficult to obtain. Ceramic materials at this time are out of reach of amateur construction budgets. The high dielectric constant of 10 or so makes circuitry very small when using this type of high dielectric constant (E_r =10 or greater) type ceramic board material.

Teflon dielectric PC board material, by comparison, also has excellent low loss at microwave frequencies—10 GHz and even higher, due to its lower dielectric constant, which can vary from about E_r =2.0 to E_r =2.6. This depends on who manufactured the board and how they constructed it. All Teflon board is excellent for microwave but there are distinct differences between different board materials.

Microwave circuitry constructed on Teflon material tends to be bigger when compared to the ceramic material. In either case, you can vary the material to suit your construction needs. For example, a 10 GHz type amplifier using ceramic can reach sizes of a quarter of an inch square for a push-pull commercial amplifier, while with Teflon the size nears one inch square for a single-stage circuit. The point to make here is that micro positioners and gold bonding equipment are mandated when working with some ceramic materials at 10 GHz, and standard soldering techniques are used with the Teflon board. This makes Teflon quite a bit easier to work with, at least at 10 GHz. Choose your board material carefully.

The converse is true when the frequency is reduced, say, to 1296 MHz. An amplifier constructed on G-10 (E_r = 5) and Teflon (E_r = 2.5) tends to make circuitry large, as we stated before. In this case, with G-10 material at 1296 MHz, a single stage stripline design would be two inches wide and four to five inches long. With ceramic this would be reduced to less than one inch wide and about two inches long. This is quite manageable and standard soldering can be employed. With Teflon PC board material bulk components such as adjustable capacitors and above-board inductors can make Teflon a good choice—it all comes together in one simple statement. Use what you have and make logical choices to maintain PC board circuitry, particularly stripline circuitry, small and workable to your application.

Make use of the engineering program PUFF I described in the May 1992 issue of *73 Magazine*. This program will give you some very good design information not only for amplifiers but for generating filter designs as well. I don't know what I would do without it. PUFF is a very powerful tool in engineering circuitry from stripline techniques.

Well, that's it for this month. If you felt we left out the 2 meter filter for your HT, well, we did, but I'll cover some of those designs next month. I will get into some simple effective ones and some inexpensive types that work quite well. As always, I will answer your questions concerning this and similar topics. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

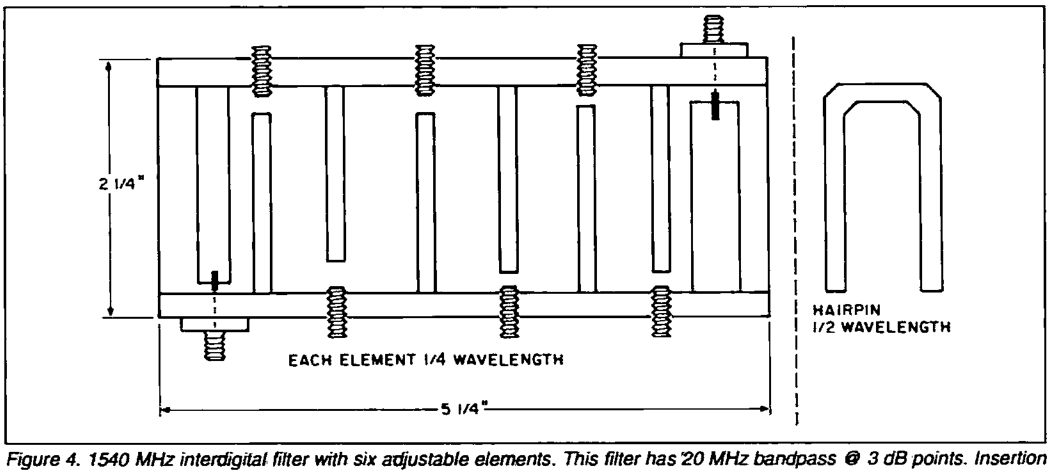

Figure 4. 1540 MHz interdigital filter with six adjustable elements. This filter has 20 MHz bandpass @ 3 dB points. Insertion loss is 0.4 dB. A 1/2 wavelength hairpin shown for comparison.

UPDATES

Number 15 on your Feedback card

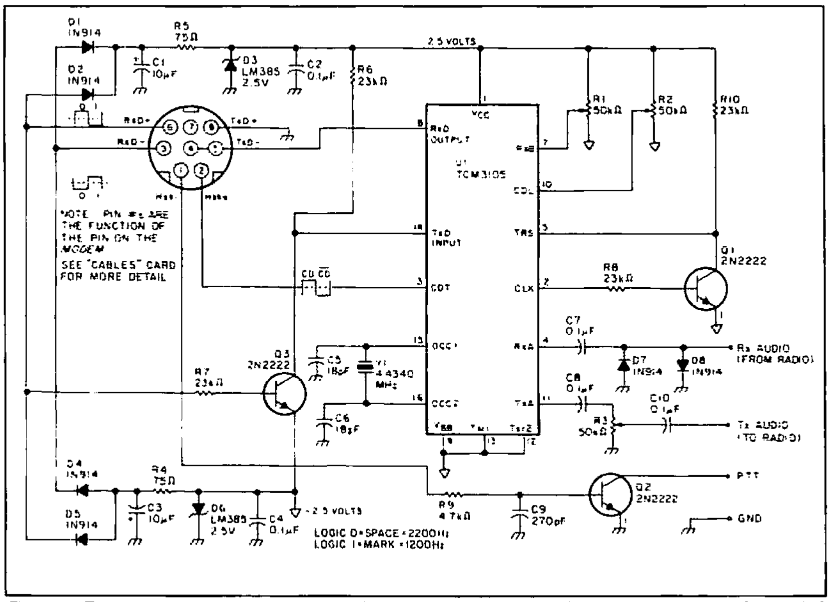

Figure 1. The corrected schematic diagram of the PacketMac Modem. Changes are to the TxD and RxD wiring, pin numbers on the connector and the -2.5 volt connections. Note, however that everything except the loopback test will work as originally wired.

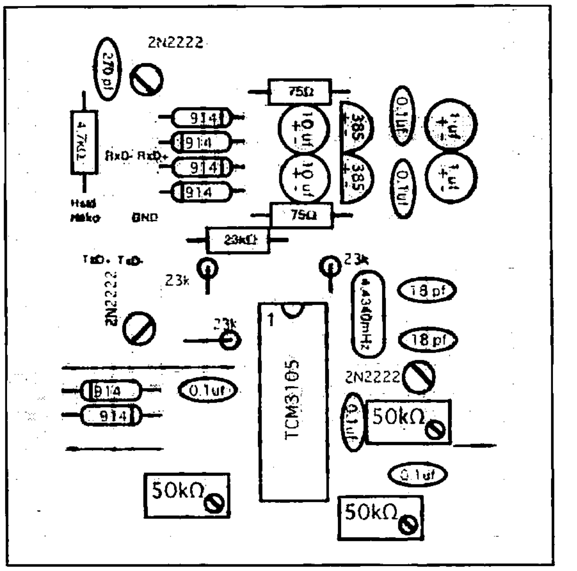

Figure 2. The corrected parts placement diagram of the PacketMac Modem showing the jumper wires as well as the new pad assignments (shown in red). Using these new pad assignments, just follow the wiring hookup chart in Figure 4 in the original article for the proper connections.

"Packet on the Mac"

Refer to the above article on page 8 of the October 1992 issue. The following corrections need to be made:

1) The jumpers were not shown on the parts placement diagram for the modem. See the corrected diagram in Figure 2.

2) The bit asserted sense of the TxD+ and TxD- lines are the same as their name, not the opposite as stated in the article.

3) See Figure 1. for the corrected schematic.

Note however, that the modem will still work fine for packet as originally wired since the NRZI encoding asserts a bit by changing state, it does not matter if the state starts high or low. The only indication that a reversal exists is that the characters received during a loopback test are the "inverts" of what was sent.

The modem can be fixed by simply swapping the wires on the mini DIN-8 Macintosh cable where it attaches to the TxD+ and TxD- pads on the modem. You could also change the modem by swapping the wires going to the RxD+ and RxD- pads.

4) Co-authors: The section on SoftKiss was written by Aaron Wohl N3LIW. Aaron can be reached at 6393 Penn Avenue #303, Pittsburg PA 15206. The section on Savant was written by Jim Van Peursem KEØPH.

Number 16 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

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Korean Star in Orbit!

Just after 2300 UTC on August 10th, a new amateur radio satellite was sent to space. KITSAT-A, now known as Kitsat Oscar-23, brought another success to the hamsat community. Our congratulations to the University of Surrey team in England and the Korean Advanced Institute of Technology (KAIST). The project manager for the payload was Jeff Ward GØ/K8KA. Jeff has been extremely active with the Surrey group for several years and is now leading some of the more ambitious programs.

KITSAT-A incorporates many of the better features of UoSat-Oscar-14 and 22. The system provides a high-speed (9600 bps) packet BBS from orbit with a new and greatly improved camera system. The satellite has six computers and an array of experiments to complement the amateur radio devices. For hams, though, great pictures from the wide- and narrow-angle cameras and the incredibly strong downlink signals have been a delight. Complete details of the satellite were described in the July 1992 "Hamsats" column.

The Launch

For those with satellite TV dishes or a quality cable TV system, the NASA-Select channel covered the launch of K-O-23 and the other payloads sent to space on Arianespace flight 52. This was only the second time an Ariane 4 rocket was launched with two strap-on solid-fuel boosters. The rocket is typically configured with more external boosters for heavy communication satellite payloads to be sent to geostationary transfer orbits.

Lift-off was just after dark, from Kourou, French Guiana. Kourou is located on the northeast coast of South America just above the equator. Daytime Ariane launches are quite spectacular. While the rocket is beginning its ascent, insulation panels peel from the structure like tree leaves falling away in a strong wind. Although the panels were not as evident during the late evening launch of mission 52, the spectacular flames from the liquid and solid boosters put on quite a show.

The flawless countdown was followed by a perfect launch.

> **"For hams, though, great pictures from the wide- and narrow-angle cameras and the incredibly strong downlink signals have been a delight."**

NASA and Pentagon representatives were present with a keen eye on the progress of the operation. Future joint ventures are expected.

The Payloads

The principal passenger, TOPEX/POSEIDON, was a Joint NASA/CNES (the French space agency) scientific payload. The satellite was built by Fairchild Space, under contract to NASA/JPL (Jet Propulsion Laboratory). It weighs 2,400 kg and has an expected life of five years. During that time it will survey ocean circulation on a global scale. The spacecraft includes sophisticated radar units, a laser retroflector array and a global positioning system receiver. The altitude of any point on the ocean can be accurately measured to within an inch.

Two auxiliary passengers were sent with TOPEX/POSEIDON. They included KITSAT-A and another small satellite almost identical in shape to Kitsat, called S80/T. The two small spacecraft were mounted on a large ring located below the main payload called the ASAP (Ariane Structure for Auxiliary Payloads). The satellites were put in place two weeks prior to launch.

S80/T was built by Matra Marconi Space for the CNES and was designed to study the use of the VHF band from 137 to 150 MHz for mobile communications. On-board power available is 26 watts, with an expected lifetime of one year.

K-O-23 weighs in at 50 kg, substantially less than TOPEX/POSEIDON. At launch, the satellite is approximately one foot by one foot, by two feet tall. The anticipated lifetime is five years. Stabilization is achieved by a gravity-gradient boom and computer-controlled mag-

Photo A. Kitsat-Oscar 23 was launched on an Ariane 4 rocket. (Photo by CSG and Arianespace.)

Photo B. The August 10, 1992, early evening launch of KO-23 from French Guiana. (Photo by CSG and Arianespace.)

netic torquer. When deployed, the boom is almost 20 feet long.

The Orbit

Due to the mission requirements of TOPEX/POSEIDON, K-O-23 is in an orbit unlike any other amateur radio satellite. Most space shuttle missions have an inclination (angle of the orbital plane relative to the equator) between 28 and 57 degrees and an altitude of less than 500 km. Most low-orbit hamsats have orbits that take them over the poles. Their inclinations are near 90 degrees and altitudes are usually less than 1,000 km. K-O-23 has a 66 degree inclination and an altitude near 1,325 km. Most Northern Hemisphere stations will find it different to track because the satellite doesn't appear to travel in a straight line. The path takes some getting used to, but the longer access times for data downloads per pass (just over 20 minutes) have been great.

Spacecraft Commissioning

Only 24 minutes after launch KITSAT-A was released into orbit and 14 hours later the KAIST ground station HLØENJ in Korea was uploading software to the satellite. Many reporters witnessed K-O-23 execute the very first command sequence sent by KAIST. Upload activities and tests continued with few problems.

During the first few days, hams noted that the K-O-23 signals were relatively weak and experienced severe fading. The satellite had not yet been stabilized and only the low-power transmitter was on. Within a week of launch the craft was completely stable with virtually no tumbling or spinning. The gravity-gradient boom was deployed and the TX1 transmitter was activated with a downlink on 435.167 MHz with 1.3 watts out (8 kHz below TX0, the low-power unit).

On August 18th, efforts began to commission the CCD camera experiment. This system includes two CCD cameras: one with a lens system capable of 4 km resolution, and another with 400 meter resolution. The cameras are connected to an 8051 microcontroller and from there to two transputers.

The first image was taken at 1740 UTC on August 19th while the satellite was over Antarctica. Satellite controllers were delighted to see an excellent picture of the edge of the earth showing cloud formations with an interesting lighting effect caused by the low sun angle. Some software bugs caused dropped frames in the transputer-to-OBC (on-board computer) path, thus corrupting later shots, but the system is currently producing excellent views with both wide- and narrow-angle cameras. Due to the orientation of the satellite, the cameras are always pointed earthward.

Working K-O-23

Kitsat's uplink (145.900 MHz) and downlink (435.167 MHz) both use AX.25 FSK at 9600 bps for normal operations. A typical earth station has 100 watts ERP (effective radiated power) on the uplink and a sensitive receiver on the downlink. Antennas range from omnidirectional turnstiles to circularly-polarized yagis. A slightly modified TNC (terminal node controller) with modem disconnect header, a 9600 bps modem and a PC-type computer running "PB" software complete the system. Any station currently active on U-O-22 can work K-O-23.

Information on the components that make up a UoSat or Kitsat-ready station can be found in the October 1991 and December 1991 "Hamsats" columns. In addition to the several devices described, a new 9600 bps modem kit has been announced by TAPR (The Tucson Amateur Packet Radio Corporation). Kits are available from TAPR for $70. Since the initial release, several bugs have been found and corrected. The July 1992 issue of the "Packet Status Register" from TAPR describes the latest modifications to the board and interface procedures for the AEA PK88, AEA PK232MBX, DRSI PC*PA and the TAPR TNC-1. The instruction manual with the kit describes the TNC-2 hook up.

Experiencing is believing. Digital communications via satellite at 9600 bps works exceptionally well. Activities that are tedious at 1200 bps flash by at 9600. Messages, programs and images can be downloaded and uploaded with ease. K-O-23 has added another fine satellite resource to the hamsat community. 73

Photo C. The first image taken by KO-23 used the wide-angle camera. (Received and formatted by NK6K and plotted by KB5UST.)

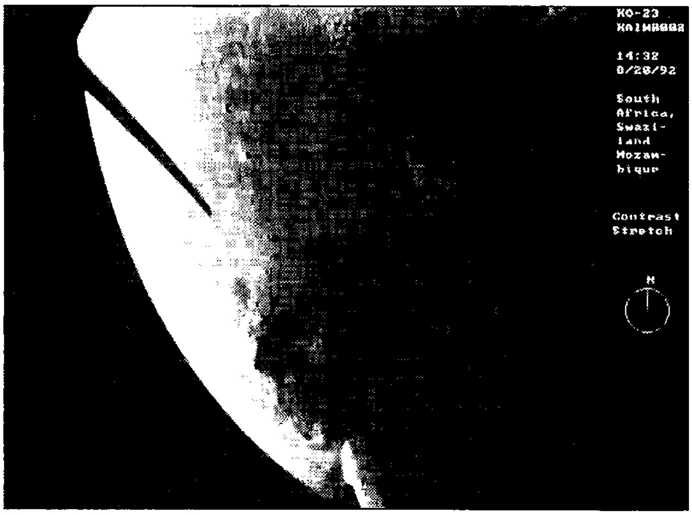

Photo D. Wide-angle view of the southern Africa coast as seen by KO-23. (Received and formatted by NK6K and plotted by KB5UST.)

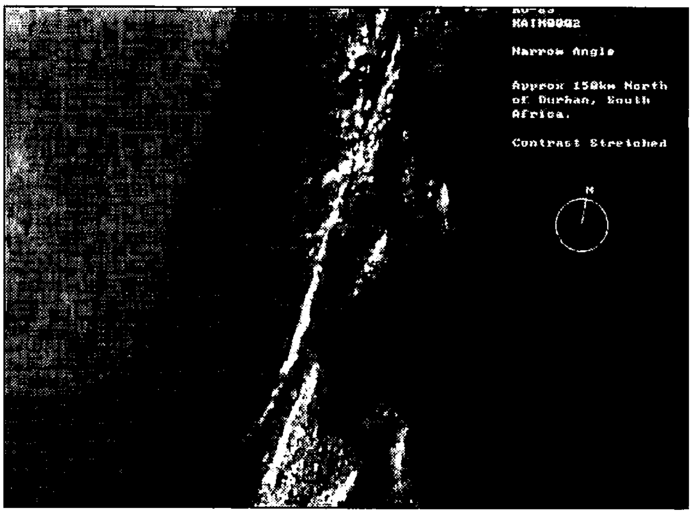

Photo E. Narrow-angle camera shot of the southern Africa coast from KO-23. (Received and formatted by NK6K and plotted by KB5UST.)

Number 17 on your Feedback card

ASK KABOOM

The Tech Answer Man

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Micro Power

This month we're going to explore micro power. No, not QRP. I'm talking about the microprocessors which are the brains of just about all of our gear these days. Sure, you know what they do for you, but how do they do it?

Just A Bit

I doubt there are very many hams out there who have no idea what a microprocessor (let's call it a "micro") is. Just about all of us have had some experience with desktop computers, and many of us have them in our shacks. And if you have a computer, you know what bits, bytes, ROM and RAM are, so I'm not going to write an entire computer primer here. But what does that mysterious little micro in your walkie or HF rig have in common with your PC clone? Well, more than just a bit.

In fact, several bits! While your desktop machine reads and writes to disks and outputs characters to its screen and printer, the micro in your rig reads the radio's knobs and buttons and writes to the display screen. It also outputs control signals to the frequency synthesizer which puts your rig on whatever frequency is shown on the display. So, how many bits does it take?

Well, desktop PCs typically use eight or more bits. Why? Because it takes at least six to represent all the upper- and lower-case characters. If you raise two (the number of possible bit states—on and off) to the power of the number of bits, that tells you how many possible combinations you can make from those bits. Two to the sixth power equals 64, so you can use six bits to cover the alphabet and numbers. But just barely. By the time you add punctuation, "control" characters (so named because they let you control the machine instead of producing anything on the screen) and perhaps some graphics blocks and such, you are way over 64 codes and you need more bits. Eight bits gives you 256 characters, which are more than enough.

So, why use more than eight bits? Well, for word processing, there's really no point. But for graphics and high-precision math, having more bits per byte lets you move more information around faster. Essentially, a computer's architecture is that of a serial device with parallel lanes, much like a multi-lane expressway. You can move just as many cars with two lanes as four, but it takes twice as long. So, many PCs now use 16 or even 32 bits.

In contrast, the micros in most radios use four or eight bits! Why so few? Well, there just aren't that many things to be coded. And speed is not an issue like it is on the PC so, if multiple bytes are needed to represent a particular piece of information, it's no big deal.

In Control

Small microprocessors with their own RAM and ROM built in are known as *microcontrollers* because they're intended to be used to control things, rather than to be the centers of large information systems. You can find microcontrollers in lots of things, from microwave ovens to VCRs, and camcorders to hard disk drives. The chip's architecture is essentially the same as that of larger systems, but the numbers are smaller. A typical microcontroller might have anywhere from 256 bytes to 2K of RAM. You sure wouldn't want to type a document into it!

The ROM, which stores the operating program, also is typically in the 2K to 4K range. Small as that sounds, it usually is enough to handle a pretty complicated radio's functions. In some cases, external ROM and RAM are used to increase the data capacity. Many HF rigs use multiple-chip systems, although some do it all on one chip. Most walkies use one or two chips.

Take It For A Spin

When you spin the tuning knob on one of today's typical HF rigs, an optical encoder (a slotted disk with an arrangement of LEDs and detectors) sends pulses to the micro. Its software reads the pulses and changes the frequency by rewriting the display and sending the proper codes to the frequency synthesizer. It may *feel* like you're tuning a VFO, but you're really just altering data! (For that matter, these days a "VFO" is nothing more than a piece of data in memory anyway.) Many other controls work the same way. Usually, the RIT, modulation mode (AM, FM, SSB, etc.), filter selection and IF shift or PBT are controlled via the micro. Some functions, like volume and squelch, are just regular old analog controls, but they too could be made to be part of the computer system and probably will be in the future. Why bother? Well, wouldn't it be nice to have the squelch "remember" its proper setting on FM but return to the wide open position on SSB?

Getting Wired

So how does a micro read a switch, anyway? Actually, it's pretty simple. Micros have "ports," which are just connections used for inputs and outputs, or "I/O," as they say. In most cases, the switch will have one end tied to ground, with the other end tied to the positive supply via a resistor of a few k ohms or more. The micro's port connects to where the resistor meets the switch. When the switch isn't being pressed, the connection point will be high. When you press the switch, it goes low (to ground). By making the micro's software examine the value of the port, the switch's state can be determined. Actually, it's almost that simple, but not quite. Switches tend to "bounce," or have rapid "ons" and "offs," for a fraction of a second when you press or release them. To avoid false readings, the software is made to wait a few milliseconds and then test the switch's state again. If the two readings match, the computer knows that a valid press or release has been made.

Hey, wait a minute, my '940 has an awful lot of buttons on it! Is there a separate port for each one? Well, probably not. That would require a *big* chip with lots of wires, and remember, hardware costs money, while software is free! To read lots of switches, an old technique, used for everything from calculator and computer keyboards to electronic telephones, is employed. It's called *multiplexing*. Here's how it works:

Drive A 4X4

Let's say you have a 16-button keypad, like the one found on most walkies. To read each switch individually requires 17 connections: one for each switch and a common ground. If instead, though, you wire them in an X/Y grid, you can do it with only eight wires. Try it on paper. Draw four rows of four boxes each. Now, connect them together horizontally and vertically. If you connect four wires at, say, the left and four at the top, no matter which button you press, you'll make a connection between a wire on the top and a wire on the side *somewhere*. Of course, multiple keys pressed at the same time can cause all kinds of confusion. The way to avoid it is to *scan* the rows and columns, looking for connections. That way, if you find more than one set, you can ignore them all. By the way, if you're trying to discern the grid pattern on a bunch of switches, keep in mind that the electrical arrangement is not necessarily related to the physical layout of the switches. Sometimes they match, but sometimes switches on unrelated areas of the rig may be connected in a grid. Ultimately, whatever costs the least will be used.

Where In The World Is Common Groundiego?

Please notice that, in the scanned arrangement, no switch has a ground! Scanning ports are specially constructed to provide a voltage pulse on one set of connections and to look for it on the other; that's how the scanning is accomplished. I've seen more than a few cases of damaged chips because someone wanted to connect a remote switch and put it between the micro and ground. If you need to connect a remote switch, you must connect it across the original one. Unfortunately, induced voltages on the remote switch's wires (such as from your transmitter) and the wires' inductance kick also can damage the micro. And you can't put a capacitor across the wires to smooth things out because it interferes with the scanning pulse, making the switch appear to be continuously pressed. If your remote switch is more than a few inches of wire away, it is best to use either a relay or a 4066 or similar type analog switch chip. Multiplexed switches can be a real pain to remote.

My Friend Flicker

By the way, the multiplexing technique works for displays as well. If you have lots and lots of LED segments to control, as you do in a frequency display, you sure don't want a wire for each one. You can multiplex them in exactly the same way, thanks to the eye's inability to see very rapid flashing. The result is that only one segment in the entire display is on at any one time, but they get scanned so fast that they all appear to be on at the same time. The technique reduces power consumption, too. Of course, the display doesn't appear as bright as it would if they were all on together, but most displays are more than bright enough anyway. LED function indicators, such as the ones used for filter and mode selections on some rigs, also may be multiplexed.

If you want to see if your display is multiplexed, try this: Turn the rig on and shut the room lights off. Now, stare at the display and move your eyes rapidly in a circle. If you see interrupted bars of light, the display is multiplexed. If all you see is a bunch of solid smears, there's no multiplexing in use. And, if you do it long enough, you may get to see Nirvana.

LCDs usually are multiplexed, too, but their inherently slow response time makes the segments stay set between scans, so they really are all on, or nearly so, at the same time.

A to D, Where Are You?

Some micros, particularly the ones in walkies, display S-meter readings in the form of LCD bargraphs. Some also show battery voltage. To do this, the analog voltage representing the received signal strength or battery voltage must be digitized and converted to bargraph steps by the micro for display. It sounds messy but, luckily, most modern microcontrollers have built-in analog-to-digital (A/D) converters, making the job very easy. There is one function, however, where the rigs cheat: All the walkies I've seen which have bargraph RF power output displays simply show a preset number of bars which depends only upon the power level you have chosen. I've never seen one that actually shows a real measurement of the power coming out of the transmitter.

Well, there's lots more to discuss, but I've run out of room. We'll continue next month. 'Til then, 73 de KB1UM.

Number 18 on your Feedback card

PACKET & COMPUTERS

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Digital Radio Glossary

Many of the letters you've sent (thanks for writing!) have had questions about basic packet and digital radio terminology. Instead of answering them individually, I thought I would give you a digital radio glossary. This is by no means an exhaustive effort, but it answers all the questions I have received and provides related information. I hope you all find this useful, and maybe something worth saving and referring to in the future. Please let me know what you think—and of any questions you have about items discussed here. Thanks for the wonderful response to the column by US Mail, and various email. 73 de N1EWO.

AMTOR Amateur Teleprinting Over Radio is an enhanced form of RTTY, including error correction (called Mode A or ARQ for Automatic ReQuest for reception) and FEC (Mode B) modes. It is well suited to noisy HF channels and reliable, though very slow. AMTOR avoids QSB (fading) and QRM/QRN (noise) by sending very small data packets, two characters at a time, giving an AMTOR QSO its characteristic staccato sound. AMTOR Mode B is excellent for bulletins and a version called NAVTEX is used to communicate with ships at sea. See: FEC.

AX.25 Amateur X.25 is a version of the CCITT X.25 protocol with enhancements for operation over radio. It is the set of rules which is used by the packet TNC to establish, maintain, and terminate a link between two stations, and to transfer data back and forth. AX.25 defines the structure of valid data frames and the behavior of the sending and receiving stations. See: CSMA/CD; Error Detection and Correction; Frame.

Backbone A network connection among LANs. Packet radio backbones are usually used to connect LANs for PBBS message forwarding, although some allow user traffic.

Baud Named for the French engineer J.M.E. Baudot (Baw'-doe), a baud is a discrete transition of a signal which can carry information. Baud is not necessarily equal to bps (bits per second) since fancy modulation schemes—using signal phase and trellis encoding, for example—can stuff more than one bit in each baud. These schemes are common in land-line applications, but generally are not used in radio since properties like phase—on which they depend—are hard to preserve.

CRC See: Error Detection and Correction.

CSMA/CD Carrier Sense Multiple Access/Collision Detection is the access method used by the AX.25 protocol to allow simultaneous use of a single channel by multiple stations. This differs from, say, land-line modem connections where the conversation is between a pair of modems—one on each end of the line. CSMA/CD is easy to understand if you think in terms of a typical group discussion on a repeater. Each station listens to the channel and waits for the currently transmitting station to finish (carrier sense).

If one (or more—multiple access) of the listening stations wish to make a comment, they will wait for an arbitrary period of time to make sure "they've got it." They don't key up right away because others might do the same and cause a double. But, even if the stations wait to see if the channel becomes busy, two can decide to transmit at precisely the same time, causing a double anyway. When this happens, the station to whom the transmission was directed will say something like, "You guys just doubled, K9HI try it again"—collision detection.

One other access method which will also be familiar to repeater users is called Token Passing. In this scheme a "token" is passed among nodes on the net. When the node receives the token, it can use the channel—though it may not want to. It makes its transmission—or not—and then passes the token on to the next node. You may have already recognized this as the scheme used in round-table QSOs: "WN9T and the group, this is N1EWO," the token is passed.

DCD Data Carrier Detect has two meanings. It is the designation of pin 8 of the RS-232D pinout standard, and it is a function of the TNC which determines if there is incoming data—or another station on the air. Because packet radio uses CSMA/CD, it is important for the TNC to know if there is another station on the air. DCD comes in two basic types. The simplest makes no distinction between actual data and anything that opens the squelch—noise, voice, whatever. The second, called Derived DCD, actually determines if there is data present. Since this type of DCD allows the squelch control to be left open at all times, it can be advantageous for older radios and high-speed transmission where the limiting factor is the speed of the squelch circuit.

Digipeater A DIGItal rePEATER is a station which receives a packet and retransmits it. The idea is very similar to a voice repeater, but is not full duplex. AX.25 allows up to eight intervening "digis," which are specified in the connect request to the TNC. Stations seeing the digipeat request will handle the packet in the order in which the list is specified. Even if the destination can hear the originator directly, it will ignore the packet until the digis handle it. All packet stations are digipeaters by default—this function of the TNC must be explicitly turned off if it is not desired.

DSP Digital Signal Processing is a relatively new technique which uses general purpose or specialized microprocessors to do the job that analog filters normally do. Since DSP-based filters can be programmed for all sorts of different behaviors, they are extremely flexible. Multimode units based on DSP are becoming available and have the advantage of being ready for any new mode that might appear by simple reprogramming of the DSP chip.

DWAIT Digipeater Wait is an important TNC parameter which determines how long a station will wait after the last transmission before attempting to acquire the channel for its own use. Digipeaters should have smaller settings than users, since they need to be able to repeat users packets. This very simple method has not been effective for busy LANs, and has been—or should be—replaced by the Slot Time parameter, which is more random.

> ***"I hope you all find this useful, and maybe something worth saving and referring to in the future. Please let me know what you think—and of any questions you have about items discussed here."***

Error Detection and Correction Packet radio has an advantage over older digital modes like RTTY because it detects and corrects errors in transmitted data packets called frames. AX.25, the packet protocol, uses a technique called CRC (Cyclic Redundancy Check) to determine if the frame arrives intact. A CRC is a mathematical operation which is performed on all data in a frame. The result is transmitted along with the frame and must match the result the receiver gets using the same operation—a mismatch indicates a detected error. The receiver then requests a retransmission, called a retry, of the frame and the process is repeated until the data arrives without error to the retry count—the number of attempts the transmitting TNC will allow—is exceeded. The retry count is a settable TNC parameter which defaults to 10.

Ethernet Developed by Xerox at their Palo Alto Research Center (PARC), Ethernet is a networking scheme that uses 10 MHz radio transmissions on RG-58 cable. It is a CSMA/CD-based system, and is quite similar to packet radio in operation. Ethernet is used throughout the Internet.

FEC Forward Error Correction is a scheme which allows broadcast messages with very low error rates. Unlike AX.25, which uses retransmission to correct errors, FEC modes send the error-correcting data along with the original transmission. This redundant information can be used to reconstruct data that is damaged upon arrival. This method is very similar to QSZ—sending each word or group more than once—in CW traffic handling. If QSB—fading—or QRM/QRN—interference—make copying one attempt impossible, it can probably be reconstructed from the repeated version.

Frame AX.25 uses data packets called frames to transmit data and link management information. There are three basic AX.25 frames:

I Frames Information-Transmission Frames transmit user data—the text of messages and bulletins, etc.

S Frames Supervisory Frames are used to establish and maintain the link between two stations. They are responsible for ACKs (ACKnowledgements) and NAKs (rejections), in addition to establishment and termination of the link.

U Frames Unnumbered Frames are used when there is no connection to another station. They may also be used during a connection for miscellaneous housekeeping.

Hidden Transmitter Because AX.25 uses a scheme called Carrier Sense Multiple Access/CD (CSMA/CD), all stations operating in a LAN (Local Area Network) must be able to be heard by all other stations—this is the carrier sense part. If not, some stations will attempt to transmit while others are on the air. This leads to collisions—like doubling on repeaters. Though the collision detection part of CSMA/CD will reject the garbled frame and acts for a retransmission, the hidden transmitter will continue to interfere until both it and the station it is interfering with "retry out" (give up and disconnect). The only way to prevent this problem is to insure that everyone can hear all stations operating in the LAN and, since it is impractical to expect all stations to erect antennas capable of this, a repeater—almost identical to a voice

Number 19 on your Feedback card

HAMS WITH CLASS

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The Antique Wireless Association: A Heterodynamic Group

This past summer I had the privilege of being a guest speaker at a hamfest in Batavia, New York. My gracious host for the weekend was Tom Rosica W2GIR, a production technician in radio and television at Genesee Community College. Tom was a 25-year employee of the former GTE-Sylvania plant in upstate New York.

It was a pleasure to be taken on a tour of this most scenic area of New York state. Tom took great pride in telling me about the good works of the Genesee Radio Amateurs, who are very active in community affairs and are prepared to help out in emergencies. This region of New York is known for severe winters and blizzards that can devastate an entire region. Tom spoke of several such occasions where the communications of ham radio operators were the only thing the community had to rely on.

I had a wonderful time speaking with many of the hams and teachers who attended my forum. Visitors to this part of our state get to enjoy a special kind of hospitality. Tom kept assuring me that no visit to this community would be complete without a tour of the world-famous Antique Wireless Association Radio Museum in Bloomfield, New York. My interest was really piqued when Tom introduced me to Bruce Kelley W2ICE, the museum's curator. For the longest time, Frank Gunther W2ALS (friend and colleague of Major Edwin Armstrong) had been telling me that I must gel in touch with Bruce Kelley and visit this most impressive museum. My only regret turned out to be that I didn't have more time to spend there on this visit. It is definitely on my list of places to revisit as soon as I can.

Bruce Kelley

In 1936, Bruce Kelley began collecting radio tubes and old gear while he was living in Rochester, New York. When Bruce was 34, In 1948, he set up a museum in his barn in Spencerport. Bruce, who worked for Eastman Kodak, became well known In the area for the extraordinary slide presentations and equipment displays that he brought to meetings and hamfests. After awhile, these activities took up so much of his time that, in 1952, he founded the Antique Wireless Association with George Batterson W2GB and Linc Cundall W2LC.

The AWA began to grow in membership, and Kelley and his museum moved to a new home and a new barn in Holcomb, New York. The "Old Timer's Bulletin" was founded in 1960, the AWA National Conference debuted in 1963, and in 1972 the AWA was chartered by the state of New York as a nonprofit educational institution. The AWA has gained official recognition in past years when it was invited to hold Its annual historical conferences al three of the nation's leading museums: The Ford Science Museum in Dearborn, Michigan; The Benjamin Franklin Institute in Philadelphia; and The Smithsonian Institution in Washington, D.C.

By 1970, Kelley's barn was overflowing and the AWA leased half of the Bloomfield Academy Building. Following renovation of the 1837 building, the AWA museum moved in alongside the museum of the Historical Society of the Town of East Bloomfield, which occupies the other half of the former school. If you are considering visiting there, or taking a class trip to this wonderful place, you should know that the Radio Museum in East Bloomfield is about 20 miles southeast of downtown Rochester and 10 miles west of Canandaigua.

The Radio Museum is a teacher's dream. Not enough museums offer youngsters, or oldsters for that matter, the opportunity to touch, feel and even smell their exhibits. Most of the displays at this museum are oul in the open to be examined and enjoyed. According to Bruce Kelley, most of their tour groups consist of school classes, Scout troops, retired folks, and antique aficionados. Admission to the museum is free.

Exposing youngsters to artifacts and relics of the past is a terrific teaching tool. The Radio Museum provides the visitor with a "feel" for what went before. This is how we come to know where we are now: by experiencing the enrichment of the things that make up our history. In this museum you will "experience" one of the largest collections of early radio apparatus—actual equipment associated with Marconi, De Forest, Armstrong, Edison and other pioneers. Much of it still works.

The AWA Museum in East Bloomfield houses more than 25,000 historical items, from early Morse telegraph keys, repeaters, relays, and other equipment, to the earliest commercial wireless apparatus (vintage 1910 and earlier) and radio receivers—which are considered to make up one of the finest collections In the United States. In addition to radio and wireless gear, the museum contains such visual equipment as the early RCA and Finch facsimile machines, and scanning disk-type television receivers.

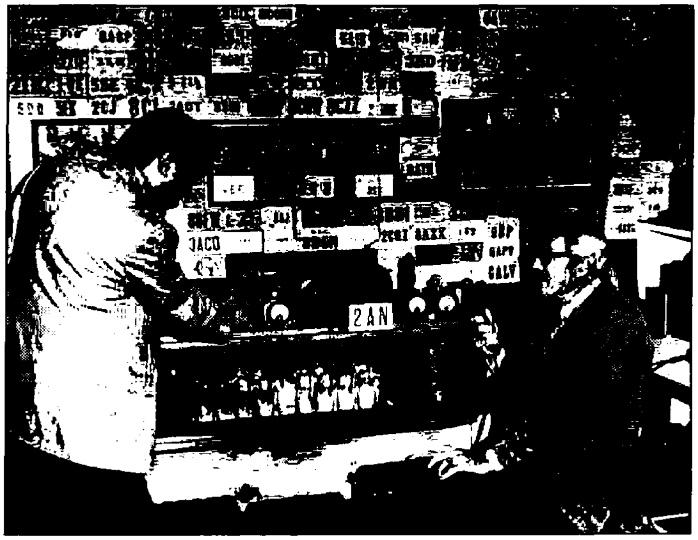


Photo A. Operating a 1923 amateur phone station at the AWA Electronic Communication Museum, East Bloomfield, New York.

Many of the exhibits have been donated by private institutions or are on loan from owner-members. There are today more than 3,600 members in the AWA worldwide. Among them are leading scholars, statesmen, scientists and industrial leaders, and many old-time pioneers in telecommunications. According to Bruce, "Membership includes Marconi ship-to-shore operators to hundreds of amateur radio operators who earned their expertise in the days of the spark gap and the coherer. In addition, there are scores of knowing antiquarians who have saved from oblivion literally thousands ol artifacts from earliest wireless days which have found a place in the AWA Electronic Communication Museum. The museum's resources include a comprehensive library of books, periodicals, photographs and documents basic lo Its research and the sharing of this knowledge with others."

Many of us enjoyed the recent showing of the PBS "Empire of The Air." This Ken Bums documentary covered the lives of three controversial radio pioneers: DeForest, Armstrong, and Samoff. The story stayed close to the excellent Tom Lewis book of the same title. A large amount of the footage was photographed or recorded in the AWA Museum, including the signals from the Association's rotary spark transmitter.

The AWA Museum is open from May through October. I heartily recommend that you put this museum on your "must see" list when you have the time. I also recommend that you bring at least one young person along with you.

For more details about the Antique Wireless Association or the Radio Museum, write to Bruce Kelley W2ICE, Main Street, Holcomb, New York 14469.

Photo B. Curator Bruce L. Kelley W2ICE with a group of school children.

repeater—must be used. Unfortunately, this is still rare—due mostly to cost.

Hierarchical Addressing A scheme which allows stations that forward packet messages to easily decode the final destination of the message. A hierarchical address runs from specific (callsign) to general (continental region). We don't yet include planet in a hierarchical address.

Internet An enormous Ethernet network with tens of thousands of government, educational, and commercial computers connected. The resources of the Internet are used by amateurs running TCP/IP to create "wormholes" that route transmissions originating on radio through the landline Internet's high capacity network. This makes it possible to connect almost instantly from the US to Australia, for example, and end up on the local Aussie AX.25 network.

KAnode A proprietary networking scheme found in Kantronics TNCs, it is similar to NetROM networking.

LAN Local Area Networks are groups of nodes—usually user terminals, like packet stations—that are connected in such a way as to directly share the network channel. In the case of packet, LAN nodes are those stations which directly participate in the CSMA/CD sharing of a frequency. This is distinct from WANs (Wide Area Networks) which are used to connect LANs together. The distinction is not necessarily tied to geography—a LAN could just as easily cover more area than a WAN—but to architecture. The interaction of LANs on a WAN is similar to the interaction of nodes on a LAN. See: Backbone.

MAXFRAME An important TNC parameter that determines the number of outstanding (unacknowledged) frames that will be allowed. This number should be lowered on busy or noisy channels; high values of MAXFRAME in these cases will cause a reduction in throughput.

Modem From MODulate-DEModulate, a modem is a piece of hardware that converts digital information into analog signals in the audio frequency range to permit their transmission over voice channels. In a TNC, the modem is the subsystem which is connected to the radio. Most TNCs are delivered with 1200 baud modems but permit the connection of other, faster modems to the digital section that handles the AX.25 protocol.

Muitimode A box which can operate not only as a TNC, but also as a terminal unit (TU) for RTTY, AMTOR, FAX, etc. The exact capabilities of muitimode units vary from manufacturer to manufacturer. Muitimode units are—of course—considerably more expensive than simple TNCs, but are worth considering if the extra functionality is interesting to you.

NetROM An automatic networking scheme that is stored on an EPROM (Electrically Programmable Read-Only Memory)—also known as a ROM, hence the name. NetROM nodes constantly exchange information about other NetROM nodes that can be heard and worked from their location. Users connecting to NetROM nodes can get a list of reachable nodes and connect to them, avoiding the time-outs and other limitations of digipeaters.

Packet The general name given to amateur computer networking via radio, it is derived from the use of data "packets" to provide data integrity. See: AX.25; Frame.

PACLEN An important TNC parameter which determines the length—in characters—of an I Frame. Larger values will increase throughput on quiet channels by reducing overhead, but will drastically reduce efficiency on channels that require retries. The default size is usually 128.

PACTOR An experimental mode for HF digital communications, developed in Germany. It takes the best parts of packet and AMTOR and combines them into an excellent system for the conditions found on the HF bands. Its legality for use by US hams is questionable, given the ambiguity of the rules concerning digital modes. There is hope, however, that this will change.

PBBS A Packet Bulletin Board System is a computer program which allows amateurs to exchange messages and provides automatic store and forward facilities for bulletins and messages addressed to distant hams. It is similar to a land-line BBS—like FIDO and other systems that forward messages.

Protocol A set of rules that specify the structure of transmitted data and handshaking (signaling used to communicate over a data channel). A protocol is something like the rules used on voice repeaters to prevent confusion and interference, though much more formal since computer programs don't think. See AX.25; TCP/IP.

Retry A request for re-transmission of a damaged frame, or the retransmission of the frame. See: Error Detection and Correction.

Rose Yet another networking scheme prevalent in the eastern half of the US. It has some technical merit and wide support.

RTTY Radio Teletype is the original form of digital communication via radio. In its original form it uses a simple 5-bit code called Baudot (Baw'-doe) which allows for transmission of only upper case letters and the figures 0-9. See: Baud.

Serial Port A communications port found on a computer or terminal. Serial ports and other serial devices send and receive their data as a string of bits, one after the other. This is opposed to a parallel port, which transmits two or more bits in parallel. Serial ports are the most common connections to TNCs and other communications devices.

SLOTTIME An important TNC parameter that works in conjunction with the PERSIST parameter to more thoroughly randomize attempts to acquire the channel. On busy channels, it is important that transmissions occur at highly random intervals after the channel is quiet, to avoid collisions. SLOTTIME and PERSIST work like this:

SLOTTIME specifies the amount of time the TNC will wait before generating a random number between 0 and 255, which will be used by PERSIST.

PERSIST sets the threshold (0-255) which will be checked against the random number each time SLOTTIME specifies one should be generated.

The exact settings of these values is a matter of LAN management and should be determined by a technical committee of the local packet organization.

SSID A Secondary Station Identifier is a number following the callsign that allows a station to have multiple connections active without collision of the packet address. SSIDs up to and including 15 are valid. An SSID of 15 is usually attached to a user's call when they are being heard through a network node like a NetROM node.

TCP/IP Transport Control Protocol/Internet Protocol is the protocol used on the Internet. It is the closest thing to the universal solvent of the networking world, and is being adopted by amateurs as an alternative to AX.25. While it has some distinct technical advantages, it is much more difficult to get running than a TNC-based AX.25 station. A suite of software, including Phil Karns' (KA9Q) implementation of the utilities needed to run TCP/IP, can be found on many BBSs. The best way to get started in TCP/IP is to find someone already running it.

Terminal Emulation Using a computer program to emulate a dumb terminal. Digital's VT series is the most common choice.

TheNet Another automatic networking scheme, similar to NetROM. See: NetROM.

TNC A Terminal Node Controller is a box containing a modem and the "brains" to run AX.25 protocol. Because of the intelligence built in, it needs only to have a terminal and radio connected to work. Some software implementations of TNC intelligence are available for use with inexpensive modems.

TNC Parameters Settings used by the TNC to determine how it will behave. Because of varying channel conditions, there is no single "ideal" set of values. Other things like callsign and text messages are also in the set of parameters. See: MAXFRAME; PACLEN; SLOTTIME.

WAN See: LAN.

QRP

Number 21 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The Argonaut II

What separates one company from another is how that company changes or improves a product, based on input from its customers. Ten-Tec is a good example. Ten-Tec began as a company producing QRP equipment and their Argonaut line has become the world standard in low power amateur radio transceivers. When Ten-Tec introduced the Argonaut II at the '91 Dayton Hamvention, there were some rough edges. The unit I initially reviewed revealed some of these rough edges and other people noticed the same things.

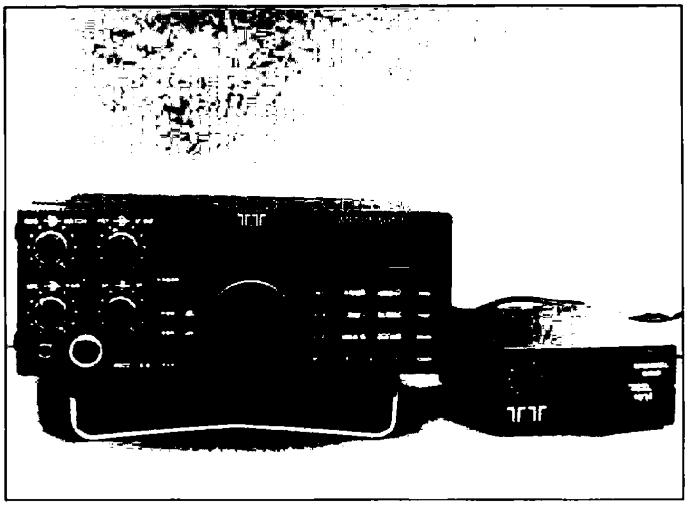
Most companies would have just weathered the storm and let the rain roll off their backs. Not Ten-Tec! At the '92 Dayton Hamvention I cornered Tom Salvetti KC3NF, vice president of Ten-Tec marketing. Tom mentioned that Ten-Tec made several changes in subsequent production runs, most in the summer and fall of 1991. The first dozen or so prototypes were the ones that got out as review units. A prototype was the one I received for the original review. Tom offered a second Argo II for me to review. Tom assured me the next run of Argo IIs would be from a different mold.

The New Argo II

"Give me a call after the Hamvention and I'll get a new Argo II for you for Field Day." Now, I might be a little slow on the uptake, but reviewing a radio during Field Day is asking for trouble. Field Day has to be the all-time worst place to test a new radio. You get all kinds of critters flying about on Field Day, from no antennas to weak batteries. Don't forget all the other stations all trying to be on the same band at the same time.

Well, several days before Field Day, the Argonaut II arrived. The first thing that got my attention when I opened the box was a full-blown manual with schematics for the Argonaut II. All my first unit had were some instructions for memory programming and some condensed operating instructions.

This time around, the Argonaut II seems to have a better fit and finish than the first unit I tested. The silkscreening seemed much clearer on the front panel. Gone are the Torx screws holding the covers on. In their place, Phillips screw heads. Now you can open the case without a trip to Sears for tools. On the back there is a jack for an external speaker (1/4" jack) and an 8-pin DIN jack for I/O ports. These ports include receive audio, T/R line and transmit audio, as well as T/R line to key an external amplifier. Ten-Tec did not include the band-line outputs on the rear of the Argonaut II to automatically select the proper band on the amplifier. Remember, you purchased a QRP transceiver in the first place. Yes, QRPers do use amplifiers, just ask Randy KD8JN but hooking up an Argonaut II to your SB220 is, well, different! If you want to run 100+ watts and then use an amplifier, get the Delta. You can turn the Delta's RF power down, too.



The Ten-Tec Argonaut II.

Many of the improvements to the Argonaut II were done to the firmware controlling the CPU. There are two changes I really like. First, in the older version of the firmware, when the Argo II went into transmit the frequency was locked. You couldn't move the frequency around the band with the main tuning knob. Now this problem has been fixed. I guess it's not the best thing to do on the bands, but band swishers are a part of life. If nothing else, it's great to swish around to find the resonate point of your antenna.

Second, the first Argo II did not like operating on battery power. When the battery voltage dropped down to 12 volts, things went kinda weird. By flashing the display on and off, the new firmware lets the user know the battery voltage is too low to operate. There

were more changes done to the firmware controlling the Argo II, but these two I really think help the most.

The first Argo II I reviewed showed different amounts of transmit current for the same amount of RF output. This time around, the current for the transmitter is within a few hundred milliamperes of each other. Transmit current ranged from a low of 2.51 amps on 80 meters to a high of 2.84 amps on 17 meters. RF power was 5 watts into a 50-ohm load. No signal receive current is 832 mA on receive with the backlighting off, and 888 mA with the backlighting on.

In the past, keying the radio with a transistor-switched keyer seemed to cause some trouble. I was able to key the Argo II using anything I had in my shack. A fix? I'm not sure, but the first ones off the line had trouble with some keyers.

For the times when you want to listen to the BBC on 5875 kHz, the AM audio response rolls off at 1600 Hz (as reported by *QST*) is easily fixed. Adjust the NOTCH control so it is 100 percent out of the circuit (fully counterclockwise). The Argo II is not a Drake R8, and it was not designed to be, but it allows for good shortwave listening. Most of the QRM fighting controls, however, are offline when in AM mode.

Field Day Testing

The real acid test came during Field Day. I set the Argo II up beside our phone station. Don Wade WD8DEA was using our ICOM 735. His antenna was a G5RV. I used a center-feed Zepp and fed the antenna with a run of 300-ohm TV twin lead and some 450-ohm open ladder line. I ran out of TV lead wire. The Argo II received its power from an 80 amp/hour battery, solar-charged of course.

Our club had a CW station, too. An old Triton 4 was pressed into duty this year for the CW station. Both the phone and the CW station were running 100 watts output.

Anyone working the event this year can tell you the band conditions were the pits. Everyone started out on a different band. After a few hours went by, we all knew how bad the bands really were. Toward the late part of the night, we somehow all managed to be on the same band at the same time. The band happened to be 80 meters; Don WD8DEA on 75 meter phone, the CW station on the one end and me in the middle.

When the CW station was on, the phone station got nailed. Turning on the attenuator, I was not only able to work stations, but I was also able to nudge up as close as 5 kHz to the CW station without getting nailed. Oh yes, I could tell when the CW station was transmitting, but I could still operate! On the other hand, Don threw up his hands and headed for the food table.

I took my old Argonaut 509 with me and swapped out the pair. I never made it to the front of the radio as the CW station nailed the 509 right then. I quickly unplugged the 509 and replaced it with the Argo II. I thought the 509, having a tuned front end, versus the Argo II's broadbanded front end, might be better. I guess not. All in all, the Argo II really did super on Field Day.

Suggestions for Improvement

Are there still some rough edges? Well, nothing is perfect and yes, there are some things that I feel need to be looked at.

With the full manual, many of the finer points in setting up the Argo II are fully explained. I would like to see a drawing on the setting of the bandwidth control and adjustable filter control. This drawing should show the approximate locations for bandwidth. Put the bandwidth control here for 500 Hz wide, here for 1200 Hz, etc. As slick as the variable bandwidth control is, Ten-Tec would really have a radio if I could have the best of the digital stuff and the crystal filters from my Argosy II. Yes, the cost of all the filters would be expensive and yes, you would lose the advantage of the variable bandwidth control, but it's a thought.

I found it hard to keep a station centered in the passband of the receiver when I tightened up the filter bandwidth. I fixed this problem by myself by setting the filter control at the 11 o'clock position and then adjusting the PBT tuning control to center the station I wanted. Leaving both controls alone, I used the main tuning knob to tune the station in to my filter/PBT settings. This seemed to work the best under FD QRM.

Using the spot function to get a station properly tuned in was difficult during the FD QRM. It worked, but I had to run up the sidetone level so high to overcome the QRM, then reduce the level to save my hearing.

The goof that I am, I worked both CW and SSB during FD. Switching from SSB to CW is no big deal, only a couple of button pushes. But, I sure miss the automatic mode selection feature most modern transceivers have. Going from 75 SSB to 40 CW and not pushing the buttons caused me no end of grief. I'd key the rig, then get a sidetone but no RF. After looking for loose wires, downed antennas and everything else in between, I noticed that the radio was in the wrong mode. RATS!! It would (should) be a simple change to the firmware to have the radio switch modes as you change frequency. Going from 7.040 CW to 7.200 SSB would then be automatic. Moving from 40 meter lower sideband to 20 meter upper sideband would also be automatic. As it is, the Argo II won't do this simple task.

The Argo II has many pluses, too. With the LCD backlighting, the display did not tire out my eyes, even at 3 a.m. Shutting off the backlighting saves only about 50 mA so I just kept it on all the time.

The semi-QSK (slow QSK) worked out quite well under the QRM of Field Day. I like to work QSK with the best of them, but FD is really hard on the ears.

I have to hand it to Ten-Tec for getting many of the problems worked out of the Argonaut II. You don't see this too many times nowadays. So, next time you work a station and he tells you, "Rig here is Argo II," he has a worldclass QRP transceiver on his desk. He has an Argonaut II. 73

Number 22 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Call our BBS at **(603) 924-9343**, *and check* **Special Events File Area #11, EVENTS.TXT** *for listings that were too late to get into publication.*

ANNOUNCEMENT

McGREGOR, TX Amateur Radio License Exams are offered the 2nd Sat. of each month at The Community Center, 2nd and Madison, at 9 AM, for all levels. Fee $5.40. Walk-ins welcome. Contact ***Alma AB5BA, (817) 859-5374***, or ***Ed AB5CG, (817) 840-3807***.

NOV 1

LEBANON, IN The Boone & Clinton County ARCs will sponsor a Ham Fest at Boone County 4-H Fairgrounds Warm & Dry Community Bldg. from 8 AM-4 PM. Set-up at 7 AM. This location is 17 miles north of Indy, just off I-65 at exit 138. Free parking. Free Tailgating. VE Exams nearby. Flea Market. Dealers. Admission $3. Table and space $2. Talk-in on 147.105 and 443.150. For info call ***Don Jackman N9ILX, (317) 482-5211*** or ***Don Lecklitner N9GBO, (317) 654-6580***, or write to ***Boone County ARC, P.O. Box 186, Lebanon IN 46052***.

NOV 7

ENID, OK The Enid ARC will host a Ham Swap Meet at Garfield County Fairgrounds' Hoover Bldg., Oxford St. and N. 4th. Admission $1 at the door. Free tables. VE Exams at 10 AM, walk-in only. There will be technical programs throughout the day. Contact ***Fred Selfridge N5QJX, (405) 242-3551*** or ***Tom Worth N5LWT, (405) 233-8473***.

EUSTIS, FL The Lake ARA will hold their annual Hamfest/Electronics Expo at the Lake County Fairgrounds in Eustis FL, from 9 AM-5 PM. Tickets $4 in advance, $5 at the door. Tables still available @ $12.50 (includes 1 free admission). Large tailgate area, spaces $5 (does not include admission). VE Exams for all classes will start at 1 PM. Contact ***Cole A. Ruck KC4UIG, (407) 273-1624***.

MILWAUKEE, WI The Milwaukee Repeater Club will sponsor the 8th annual 6.91 Friendly Fest, rain or shine, from 8 AM-1 PM at Serb Halls 1 & 2, 51st & Oklahoma. All on the ground floor with easy access. Set-up at 7 AM. Advance tickets $3, $4 at the door. 4' Tables $4 in advance, $5 at the door. To save $1 per ticket or table, send SASE with payment to ***The Milwaukee Repeater Club, P.O. Box 2123, Milwaukee WI 53201*** before Oct. 31. VE Exams on site. Talk-in on 146.91- (The Friendly Rptr.) and on 146.52.

NOV 8

LONG ISLAND, NY The Radio Central ARC will hold their HAMEXPO at Suffolk Community College, Long Island Expwy. exit 62, Nicholls Rd./County Rd. 97 North 1 mile. All indoor Flea Market. Ham Dealers. Computer Show. Free parking. VE Exams. Admission $5 at the door. Tables $20 in advance. Send to ***Radio Central ARC, P.O. Box 680, Miller Place NY 11764***. Talk-in on 145.15-4Z or 449.525-2A. For info call ***John Mark KB2QO, (516) 689-6336***, or ***Jo Ann Colletti N2IME, (516) 399-1877***.

NOV 14

MONTGOMERY, AL The Montgomery ARC will host the 15th annual Montgomery Hamfest in Garrett Coliseum at the South Alabama State Fairgrounds, located on Federal Dr. from 8 AM-3 PM. Free admission. Free parking. Flea Market set-up 3-8 PM Nov. 13th, and 6-8 AM Nov 14th. All indoors. No reservations required. FCC Exams on-site beginning at 8 AM—bring original and a copy of your current license, picture ID and $3.00. Talk-in on 146.24/.84 W4AP. Ragchew on 146.32/.92 (with phone patch, *up/#down), 147.78/.18,449.50/444.50. Special Hamfest rates at Days Inn, I-85 Exit #3; desk phone ***(205) 269-9611***; or (across the street from the Hamfest, ***Coliseum Motel, (205) 265-0586 or 1-800-876-6835***. For info, write to ***Hamfest Committee, c/o 111 Diane Dr., Prattville AL 36066***, or phone ***Jiggs, (205) 365-0380***, or ***Fred, (205) 270-0909***.

NOV 14

PLYMOUTH, MA The Mayflower ARC will host a Flea Market at the Plymouth Memorial Hall Bldg. in

Plymouth Center (RT3A) from 9 AM-3 PM. Admission is a $2 donation; children under 12 free. Tables $12 ea. in advance, $14 ea. at the door if available. Walk-in VE Exams. Talk-in on 446.625 and 146.55 simplex. To pay for tables, mail checks with an SASE to ***M.A.R.C., P.O. Box 766, Dept. FM, Plymouth MA 02361***. For exam info call ***Dave KA1TXO, (617) 585-1351***. For Flea Market info, call ***Jon WS1K, (508) 746-0162***, or ***Jim NM1F, (508) 747-2224 eves.***

NOV 14-15

F. WAYNE, IN The 20th annual Fort Wayne Hamfest/Computer Expo/1992 ARRL Indiana State Convention will be sponsored by AC-ARTS, and held at the County War Memorial Coliseum. Doors open Sat. 9 AM-4 PM; Sun. 8 AM-3 PM. VE Exams both days. Coliseum parking $2 per car. Flea Market. Admission $5. Commercial tables $30. Flea Market tables $15, (electricity $25 extra). Reserve tables by Nov. 6th. Talk-in on 146.88- and 443.80+. Send SASE to AC-ARTS, P.O. Box 10342, Fort Wayne IN 46851. For general info call ***Don Gagnon, (219) 484-3317***. For table info call ***John Rufner, (219) 483-6305***.

NOV 15

BENSON, NC The Johnston ARS, Inc. will hold its annual "JARS-FEST" at the American Legion Complex from 8 AM-4 PM. Tickets $4 in advance, $5 at the door. Tables $6. Tailgating $3. Set-up at 6:30 AM. Contact ***Bill Lambert AK4H, Rt 3 Box 315, Benson NC 27504. Tel. (919) 894-3352 between 7 PM-10 PM.***

BRANFORD, CT The Southcentral Conn. ARA will hold its 13th annual Flea Market at the Branford Intermediate School, at 185 Damascus Rd. Sellers 7 AM. Buyers 9 AM. Advance Tables $15, $20 at the door. Admission $4. VE Exams. Reservation deadline (in writing, no phone) Nov. 1. SASE to ***SCARA, P.O. Box 705, Branford CT 06405-9998***. For info call ***Brad, (203) 265-9983***. Talk-in on 146.01/.61.

MATTAPOISETT, MA An Amateur Radio Flea Market will be held at Knights of Columbus Hall. Admission $1. Table and space w/one admission $10. Set-up at 7:30-9 AM. Talk-in on 146.52 MHz. Please call or write if you have an interest in taking exams. Contact ***Kenneth Rapoza K1NSX, 19 Golf St., Fairhaven MA 02719. Tel. (508) 993-3993***.

NOV 21

PARK RAPIDS, MN The Smokey Hills ARC will hold a Ham Fest at the Eagles Club from 9:30 AM-3:30 PM. Tickets $3. $4 for a table and admission. Talk-in on 147.30. Contact ***Nick De Carlos, KA7VLH, Rt. 1 Box 352A, Park Rapids MN 56470***.

SUMTER, SC License Preparation Classes are being offered by the Sumter ARA. For info write ***Sumter ARA, P.O. Box 193, Sumter SC 29151***, or call ***Dan WB5SGH, (803) 773-9106***. Walk-ins okay.

NOV 22

ILFORD, CT VE Exams are scheduled for 12 noon at the Fowler Bldg., 145 Bridgeport Ave., by the Coastline Amateur ARA. Walk-ins. All classes. Contact ***Gary NB1M, (203) 933-5125***, or ***Dick WA1YOE, (203) 874-1014***.

WASHINGTON, PA The 5th annual Tri-State Hamfest/Computer Fair will be held at the Chartiers Houston High School from 8 AM-3 PM. This all indoor event is located 1.5 miles from Exit 8 off Interstate 79. Admission $3. Children under 12 free. Talk-in on 146.52 simplex. Directions on 145.49/144.89. Contact ***Bob McCloskey, c/o WACOM, P.O. Box 1386, Washington PA 15301. Tel. (412) 695-8608 after 6 PM.***

WHEATON, IL G.M.R.S. of Illinois, Inc. will host their annual "Winter Fest 92," at DuPage County Fairgrounds, 2015 W. Manchester, from 8 AM-1 PM. Set-up at 6 AM. Tickets $4 in advance, $5 at the door. Tables $10 in advance, $12 at the door. Talk-in on 146.52 direct; 462.600, PL 173.8. Contact ***G.M.R.S. of Illinois, Inc., 2077 W. Roosevelt Rd., Wheaton IL 60187***.

DEC 5

FARIBAULT, MN The annual Courage Center Handi-Ham Winter Hamfest will be held at the Eagles Club, starting with registration at 8:30 AM. There will be a Handi-Ham equipment auction. Dinner at noon and program. Talk-in on 146.19/.79. Contact ***Don Franz WØFIT, 1114 Frank Ave., Albert Lea MN 56007***.

DEC 6

HAZEL PARK, MI The Hazel Park ARC will hold their 27th annual Swap and Shop at Hazel Park High School, 23400 Hughes St, from 8 AM-2 PM. Tickets $3 in advance or at the door. Tables $12 (reservations for tables must be received

with check, no phone reservations.) Free parking. Talk-in on 146.64- (DART). For reservations and info, write to ***HPARC, Box 368, Hazel Park MI 48030***.

DEC 8

LARGO, MD To benefit Prince George's County RACES/ARES, Inc., HOLIDAYFEST 92 will be held from 8 AM-4 PM at Prince George's Community College Campus (exit 17A or 15A Capital Beltway). Donation $4. Tables $20. Symposium presentations, free VE Exams by Laurel VECs; please bring your original license/CSC or photocopy. Special CW speed challenge contest. Contact ***HOLIDAYFEST 92, P.O. Box 1037, College Park MD 20740. Tel. (301) 572-2362***.

SPECIAL EVENTS ANNOUNCEMENT

GERATOL NET Greetings Extra Radio Amateurs Tired of Operating Lately. The Geratol Net (for amateurs of all ages, from all states and the Canadian provinces) helps to assist U.S. Extra class amateurs and other operators (whose privileges allow them to use the Extra class portion of the 75 meter American phone band) to obtain the ARRL, 2-letter Extra Class SSB, WAS award. The number on the ARRL Certificate is known as the Geratol number. This nel also aids those operators on the completion of the Canadian 2/80 Award offered by the Metro ARC. The Geratol net is not a DX net. For the purpose of this net, Canada is not considered DX. The Geratol net meets every night at 0100Z on or about 3.767 MHz, depending on QRM, and continues to operate until all hours, depending on band conditions and check-ins. For more info on the net, awards and endorsements, send a #10 SAE with 2 units of postage to ***WØYTZ, 300 Valley View Dr., Ord NE 68862 USA***.

NOV 1

DELAWARE The members of the Warminster ARC will conduct their 4th annual DXPedition to the rare state of Delaware and will operate Station WA4DFU/3. Frequencies: 7.275, 14.275, 21.375 and 28.375 MHz. CW contacts will be made on request. QSL with SASE to ***Warminster A.R.C., Box 113, Warminster PA 18974***.

NOV 5

CLINTON, NC The Sampson County ARS will operate Station AB4TT from 1700-2400Z for the Sampson County Expo and Pork Festival. Operation will be in the lower portion of the General bands. For a certificate, send QSL and SASE to ***SCARS, P.O. Box 64, Clinton NC 28328***.

NOV 7

SANTA ROSA ISLAND, FL The Serious Hams ARC will operate Station N4MAD from Ft. Pickens State Park (IOTA 142) from 1200Z-0000Z on 80, 40, 20, 15, and 10 meters in the code and voice portions of the bands. Contacls made to Station N4MAD will receive a special QSL card. Sorry, no certificates this time.

NOV 7-8

HONOLULU, HI Hawaii Army MARS members will operate WH6R to commemorate the 50th anniversary of the rescue of Capt. Eddie Rickenbacker. Activities are planned for all bands, all modes, Including the Novice subbands. Look for us al the lower portion of each subband, Nov. 7 1900Z-1900Z Nov. 8. For QSL please send your card and SASE to ***Joe Mao, 3251 Pakahu St., Honolulu HI 96822***.

NOV 14

FT. PIERCE, FL The Ft. Pierce ARC will operate KN4RY from 1400Z-2100Z to commemorate the 7th anniversary of the UDT-SEAL Museum. Operation will be on the General portion of 40, 20, 15, and the Novice portion of the 10 meter band. For a certificate, please send a QSL and a large #10 SASE to ***Fort Pierce ARC, P.O. Box 4, Ft. Pierce FL 34954***.

NOV 28-29

PLYMOUTH, MA The Whitman ARC will commemorate Thanksgiving by operating Station WA1NPO from 1400Z-2100Z each day. Frequencies: 3.970, 7.270, 14.270, 18.140, 21.370, 24.970 and 28.370. WA1NPO will operate from historic Plimoth Plantation, overlooking Cape Cod Bay. A special QSL card will be sent to those Hams and SWLs sending an SASE. A special 8 1/2 x 11 certificate with the Mayflower II in the background, is also available for this event. Send replies to ***Whitman A.R.C, P.O. Box 48, Whitman MA 02382***.

DEC 5-6

GUANTANAMO BAY, CUBA The Guantanamo Bay ARC will operate Station KG4CA from the U.S. Naval Base at Guantanamo Bay, Cuba, from Dec. 5 0001Z-1700Z Dec. 6, to celebrate the 40th anniversary of Cuban-American Fraternity Day. Operation will be SSB and CW on 20, 15, and 10 meters. For QSL send QSL and SASE to ***Guantanamo Bay ARC, PSC 1005 Box 73, FPO AE 09593-0146 USA***.

Never Say Die

Continued from page 4

self I'd write a book on how the mind works and how to fix it, complete with anecdotes on the people I helped.

At the foundation, we learned by working on each other. While the process is lightning fast In comparison to psychiatry or psychoanalysis, it's still slow enough so those working with it don't see startling changes on a day-to-day basis. Week to week, yes. In the work done for me I found myself being held down by two doctors and my parents when I was four years old. My ear was infected and they'd decided to operate on it. I was frightened as they put the ether mask over my nose and mouth.

Then there was the time I got across my 2,000 volt power supply and was thrown six feet across my hamshack. Whammo!

After a few weeks of erasing these painful memories, plus those of a lot of very painful beatings by my father, I found my awareness had improved enormously, as had my ability to think.

At this time I was faced with another career choice. Should I go back to radio work? Should I go back to being a television director? Or should I be a therapist? I tried the therapist business for a while, working on something over a hundred patients and having some amazing successes. But I found that most people preferred to live with their problems. This was frustrating. This was very frustrating. I'd meet people who stuttered, or who had other easily curable physical or emotional problems, but didn't want to do anything about them. I decided it would be better to pursue a technology-oriented career.

If we can ever get over the concept that psychiatrists, psychologists and psychoanalysts can cure mental problems, we may be ready to get to work actually repairing minds. It's easy to do. It's fast. And you don't have any relapses. I'd like to see the basic concept incorporated into a computer program which would help doctors to diagnose not just a patient's physical illness, but also isolate the root emotional (subconscious) tie-in so that can be erased. That'll resolve many physical illnesses a lot faster than pills. The whole system is routine enough so it could be made into a computer program.

We do need a lot more research so we'll know what kind of successes we can have with things like dual personalities, multiple sclerosis, cancers, alcoholism, and so on. Another aspect that needs more research is the past-life phenomenon. Many psychiatrists run into this and dismiss it. Some have had considerable success in treating past life traumas just as if they were real. I started to do some research in this field, but didn't follow through. I did find that every person, under hypnosis, can be regressed to times of great trauma in what they say are previous lives—or, more often, past deaths. Being pragmatic, I found the whole thing interesting, but I wasn't sure whether these were real, or just imaginary. I found that when I erased them, just as I would a present-life trauma, the patient would change significantly and seem no longer influenced by the events. People with a great fear of water, when regressed to find the cause, would pop instantly to a drowning death. I'd erase the trauma response and they'd no longer be afraid of the water. Oddly enough I was unable to find any water-related traumas during their present life, even during the prenatal period. Well, real or fantasy, what I was doing did the job, and that was what counted.

Many people dismiss past lives, psychics and so on as fantasy. I remain a skeptic, but one with an open mind. I've had too many instances of psychic phenomenon during my life to refuse to even consider that we may have a lot to learn about all this yet.

During one of the more traumatic moments of my life, when I was terribly distraught, the telephone rang. It was my mother, 120 miles away. She said, "What's wrong? I know something's terribly wrong." Coincidence? Hardly. This was the only time in my life she ever called like that, and she had no way of knowing I had any problems. So I'm open to know more about life, death, and other pseudo-scientific matters. I'm not a passionate believer, just a skeptic who wants to know more. I believe we still have a lot to learn. There are just too many unexplainable anomalies—too many loose ends that need tying.

Magnetic Fields

WARNING: The Electricity Around You May Be Hazardous to Your Health—by Ellen Sugarman—Simon & Schuster—$11.00.

This fascinating book tells the story of the criminal cover-up by power companies, dishonest scientists and even the White House of the death and serious health problems caused by 60 Hz power line magnetic fields. Remember, one of the leading researchers in the field is Dr. Ross Adey K6UI, who has proven in his own research the incredible power to affect cell growth of even very small magnetic fields. Power lines, pole transformers and other sources of magnetic fields are causing leukemia, brain cancer, and a whole range of other immunity-weakened health problems.

You can get the straight skinny on the extent of the cover-up via this new book. The chap who originally blew the whistle on this health hazard was Paul Brodeur, the same fellow who eventually was able to convince people about the dangers of asbestos. The government and business approach is the same with magnetic fields as it was with asbestos and cigarettes: Deny it, then produce paid scientists to deny it . . . and eventually to be forced by the public to face the situation. The power companies are still in denial and the public is paying the price through high childhood leukemia deaths, brain tumors, miscarriages, and so on.

The most critical source of these fields in the home are electric blankets, water beds, nearby pole transformers and poor house wiring. But not far behind comes ham radio amplifiers, which may help explain why hams are dying of cancer at far above the average. Have you measured how many cell-disruptive milligauss you have going through you when you operate?

Look for the book in your local book store or call Uncle Wayne's for a copy.

The Dream Station

My wife has been bugging me. She says now that I'm 70, I should be able to have the ham station of my dreams. Yes, I know, our wives usually bug us about how much we're spending on our ham gear, not how little, so perhaps I'm fortunate to have mine pushing the other way. But it's an uphill push. I'm not known as Wayne The Frugal for nothing. That NSD in my call stands for Never Spend a Dollar. Yes, I'm cheap. When haircuts got up to a dollar I bought a pair of scissors and have cut my own ever since. Lordy, they must be up to near $2 by now! Look at the money I've saved.

So I need some help. Yes, I'd like to have a great ham station, but I want to get the best bang for the buck I can, not just go out and throw money at the top of the line stuff, just because it's expensive. Sure, I wear Rolexes, but they only cost $25 in Taiwan. Oh, I had a real Rolex once—used it for years, then it got swiped when I sent it in to the Rolex people to be cleaned. A friend of mine, Jean Shepherd K2ORS, got it for me at the discount store at Shannon Airport back in 1957. It was one of those Submariners, good to 300 feet. Since I'm only good to around 200 feet I felt the margin for error was just fine. It had a movable bezel, which was handy when I had my own plane.

When the insurance money came I blew it all on one of those new digital watches. Yep, I managed to get in there and grab one before the price dropped—before Casio got into the business. I got in there early on calculators too, buying a bunch from MITS for $129 a whack just weeks before the price dropped to $12. Who wants any of those cheapo calculators, right?

This time I'd prefer to get in on the other side of the price curve. Look, if you were going to put together a dream ham station, but were faced with a seven-generation genetic need to be frugal, what would you pick? What HF rig? What amplifier? What tower? What beam? Keep in mind that I need to have a whammo signal. As it says in "December Song," I haven't got time to play the waiting game. I've got so much lined up to do and so few hours of life left in which to do it that I'd rather put a few bucks into a humongous signal that gets answered on the first call in a pile-up instead of being down there in the second or third layer and having to frustrate it out, hoping the band won't change before I'm finally heard. I've paid my dues in that department. The fact is it doesn't have to cost all that much extra to have a first layer signal and the investment is well worth it. I want to be able to get on the air, make a contact and talk without fighting the QRM endlessly—without having to keep my contacts down to a signal report, name and QTH. I've worked my 350 countries—did it long ago, so I don't have to prove anything. I want to be able to talk with my friends in Hong Kong, Sabah, New Zealand, Jordan and so on, not have to fight to get heard.

So what do you recommend? How do you like the rig you're using? What's wrong with it? What's right? I'll bet I'll need a full-sized single-band 20m beam—what do you think? Should I get a tilt-over tower so I can fix it when something goes wrong? A crank-up? I'm not sure I want to climb 100-foot towers for many more years. I've paid my dues there too.

Should I look around for a used ICOM 730 or something like that, or go bananas for a multi-kilobuck rig? I'm not into impressing anyone with the magnificence of my station, I just want one that does the job and will make it so I can talk about more interesting things—providing I can find a ham somewhere with an actual interest in talking. Perhaps I'm asking too much. I had a 730 but one of my editors left it behind when he was on St. Lucia helping out after a hurricane. I hated losing that rig.

I had a Kenwood 830 that I really liked. Alas, a *73* editor swiped it. I even had a panoramic adaptor for it so I could find empty channels a little easier. So if you had an uncle who was a noted skinflint, what would you recommend?

Iraq Retakes Kuwait

How'd you like to see that one in the headlines? I'll be surprised if it doesn't happen—and without the U.S. lifting a finger to stop it. Further, I'll be even more surprised if Iraq doesn't keep right on going on down the old Arabian peninsula, gobbling up Saudi Arabia, Bahrain, Oman and points south.

Well, we'd never put up with that sort of nonsense! We'd be right over there lobbing missiles down Baghdad chimneys again, right? Not if Saddam plays it they way I would if I were holding his hand. Ask me how I'd pull this one off.

Glad you asked. The next thing you're going to ask me is what this has to do with amateur radio. What's the matter with you, got monomania and interested in nothing but hamming? Well, I'll get to the ham relevance. Hang in there, but in the meanwhile take off your bloody blinders. Hamming is fun, but it isn't everything.

So here's how I'd go about cornering the world's oil if I were sitting in a deep bunker in Baghdad scheming. First I'd invest in a few more tank trucks so I could run more of my oil down to Aqaba via Jordan. Jordan, cut off by the other Arab countries from their old support payments, is in desperate need of the toll money for the use of their highway and port. Remember, Jordan has no natural resources or industries, so they need anything they can get from Iraq.

Instead of buying more food for my people I'd build up a little kitty to send along with some friends of mine when they visit the ex-Soviet countries. They'd be shopping for the best deal we could get on a couple of atomic bombs (also known as devices).

The next step would be to buy a small suitcase for each of the bombs and smuggle them into the U.S. I'd set up one in downtown Manhattan and the other in Washington, over near the Capitol. Then I'd announce my plans for Kuwait, explaining about the bombs and suggesting that we not hurt each other.

While much of the country might cheer the loss of Washington, which has very few redeeming values, the possible loss of the New York pimps and transvestites might act as a deterrent to our military. While we don't want to lose all that oil, we might not want to lose a couple million people in New York even more. Having lived in New York City for many years, I'd trade it off in a minute for almost anything, but I doubt if our president will know it as well as I and will thus be inclined to wimp out.

But what about Europe? What about Germany and France? England? Hey, Bush had to drag them kicking and scratching into the Gulf War last year, even though we did most of the dirty work. They seem more interested in selling Saddam plutonium processing equipment than bombing him.

Since Saddam probably isn't as unprincipled as I, I'm sure we'll never have to worry about the scenario I outlined. It's always possible that no matter how difficult things get and how hard up the ex-USSR countries are for food and cash, they'll not sell any nukes. How much would you like to bet? Hey, China has nukes too, and they seem to be willing to sell just about anything to get cash, so perhaps we ought to stop needling them about killing all those pesky students. Doesn't what they do to their people, no matter how despicable, come under the heading of an internal matter and therefore is none of our butinsky meddling business?

In view of the above, how much should we hams get involved in setting up high speed emergency communications systems? Should we breathe easily, now that international communism has been soundly defeated by capitalism? Or should we maybe plan ahead in case something goes wrong?

One more thing I'd like explained is why the Russians haven't stopped building new and bigger nuclear submarines! And why have they stepped up their intelligence operations in America? I thought they were short of cash and were begging for a whopping loan from us to tide them over. Does this mean we're about to lend them money which, in essence, will help them build bigger, better and quieter nuclear submarines? I hate to seem dense about this, so if you can explain what's going on, I'm waiting. In the meanwhile perhaps we shouldn't decommission too many of our submarines. And we might just put a little effort into building a national high speed emergency traffic system. And is this really the time to stop experimenting with unattended packet relay stations on the low bands?

I wonder if every single ham club in America will expect someone else to actually do something about this? Hey, it's just that old doom & gloom Wayne again? When was the last time he was ever right about anything?

Hanging's Too Good

Please let me know when you're beginning to get fed up with hearing bad language on the air. Oh yes, you might send a copy to the ARRL, which seems to be unaware that we have an increasing number of very sick individuals exercising their freedom of speech on our ham bands. Now that stuff may be just fine for radio and television, but there are a majority of us who don't want to have to listen to that kind of . . . er . . . baloney when we're hamming.

Having spent a few years in the Navy, there aren't any combinations of words that bother me. Indeed, I use a few myself when the situation seems appropriate. But I have never used 'em over the air and it annoys me when I hear hams doing it. CB is well known for this kind of expression, yet I've heard far less bad language on CB than I have on our ham bands.

Perhaps I should remind you that there have been just two people arrested, tried, convicted and sent to prison for using bad language over the air. Yes, they were both doing this on CB. And yes, of course both were Extra class hams. Both had passed their 20 wpm code tests, the filter old-timers assure us will keep amateur radio ethnically pure.

Almost every amateur except the tiny overly vocal minority causing the trouble gets upset when faced with this filth. The knee-jerk reaction is to turn to the FCC in outrage. The anger these maggots incur causes otherwise rational amateurs to completely forget the League's endless promises to the FCC that amateur radio is self-policing. They also forget that the FCC is woefully underfunded and has no budget for policing our bands. They forget that the FCC has its hands tied by the Supreme Court when it comes to the freedom of expression. They forget that amateur radio is an expensive luxury which costs the FCC big bucks and that we are not paying one cent for this

QSL of the Month To enter your QSL, mail it in an envelope to 73, Wayne Green Inc., 70 Route 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to 73. Entries not in envelopes cannot be accepted.

service. They forget that megabuck communications companies are pouring millions of dollars into lobbying efforts aimed at pressuring Congress and the FCC to take away our bands. They forget the success UPS had in grabbing 40% of our 220 MHz band not long ago. They forget that as a group we have contributed pathetically little to our country in the last 20 years. They forget that modern communications technology is making our slow, error-prone emergency nets of little more than historic interest. They forget that before the 1964 ARRL holocaust, which stopped our growth and killed off over 90% of our American ham industry, amateur radio was contributing new technology breakthroughs and pioneering on a regular basis. They forget that the world doesn't care what we did 30 or 50 years ago, it wants to know what we've done lately. The answer is not pretty.

A Solution

Outside of my usual hand-wringing over the fix the League has gotten us into . . . my contribution in the way of League-bashing, as it's called . . . or League truth-telling, as I see it . . . what's the answer when we hear garbage pouring out of our loudspeakers? The answer is the same one I've proposed before, but which, as far as I know, not one single ham club in the entire country has acted upon, is to get the League off its duff and off the golf links long enough to tackle the problem.

I've proposed a number of approaches the League could take to help us clean up our bands if they had the slightest interest in living up to their billing as our national society. I'll know they're taking an interest in something more than selling subscriptions to *QST* when I see they've established at least a one-person department at HQ dedicated to cleaning up our bands.

The first step I'd take if I were going to tackle the problem would be to petition the FCC for a rule change which would make it easier to unlicense offending hams. Right now it's easier to apply the death penalty than to take away a license. Somehow the concept seems to have gotten into the public conscience that a ham license is a right instead of a privilege. Wrongo.

Look, we've acquired the responsibility for issuing licenses via our VECs, so why shouldn't we have the power to take licenses away? So let's get the rules changed to give us the power to actually do the self-policing we keep telling the FCC we're doing. We aren't doing squat. Yes, we need some safeguards to protect honest, clean-living amateurs from small gangs of rascals . . . the old crooked sheriff syndrome. But losing an amateur radio license is not comparable to being thrown into prison or executed. Let's get a rule which will allow the filth repeater in Los Angeles to be cleaned out once and for all. Let's get a rule which will let us clean out the nuts ruining 20m. And let's make sure the rule has no opening whatever for lawyers to get their scum-sucking hands into the system.

We're being licensed by our peers, so let's get organized so our peers can de-license our mistakes. We don't have any test for IQ or sanity when we give a ham test, so we're going to get weirdos. We know that kids interested in amateur radio are generally considered nerds and dweebs, so we should do all we can to clean our bands of nut cases and ranting fanatics.

Do I have to work out the proposed rule change in detail, thus giving you the opportunity you're waiting for to find some aspect with which to find fault? I'd rather have you come up with what you recommend so I can have the fun of telling you how stupid you were to suggest this or that. Why should you have all the fun? As far as I know there is little perceived fun in coming up with creative, constructive suggestions and endless fun in ridiculing any perceived negatives—no matter how exaggerated.

So, if your brain hasn't already been turned to kimchee by listening to the stink on our ham bands, let's see what you can come up with. Then, let's see if you can get through to any of the ARRL old-timer directors and get their attention. I'm giving odds of 50:1 you won't get anywhere.

We've been billing ourselves as a self-policing service, so isn't it about time we paid more than lip service to the concept and started organizing ourselves to do what we say we do? And we can do it, if we have the leadership we need. Do you get the feeling that we're running just a tad short on leadership? And no, stop writing me asking me to start a new national ham organization. I've got enough aggravation in my life without geting involved with that. You just want someone else to do the work instead of you. Well, get off your butts and make the League do what they should. Get them busy cleaning up our bands. Get them into gear to help us rope more kids into our hobby so we'll have some inventors and pioneers to help us hold our bands.

Uncle Wayne Broadcasting

Yep, I'm on for an hour or so every week, coming to you by satellite radio every Thursday evening at 9 p.m. Eastern time, 6 p.m. LaLa Land time. And yep, you can even call in and give me a hard time.

What do I talk about? Anything and everything. Sure, I talk a lot about amateur radio, I talk about diving, skiing, psychology, cooking and so on. I talk about my experiences during the war in a submarine. I talk about what's gone wrong with our country and how to fix it. I talk about making money, flying, horseback riding and so on. I even talk about no-nos like religion, pro-life vs. pro-choice. I talk about Bush, Quayle, Clinton, Gore and even Perot.

I'll be talking about music and trying to get you interested in listening to some different kinds of music. I talked a bit with one listener about loudspeaker design and how I put the Karlson speaker on the market and built a million-dollar business within two and a half years, starting from scratch.

If you can tune in Spacenet III, Channel 21 (6.2 MHz subcarrier), you'll be able to keep track. And you can call in to kibitz via (310) 824-6991 during the broadcast. Hey, I'll talk about anything you want to hear.

My latest enthusiasm has to do with tying together quantum mechanics, holography, and chaos theory, if you've read up on these incredible developments. How do these tie in with a completely new perception of the real world? It'll take some explaining, but the ramifications are so enormous that it's worth learning more. Are we close to being able to eliminate all illnesses? I said all! I believe this is within our grasp, if we reach in a completely different direction.

Our health care system today is much as if we spent all our time learning how to repair people better after serious car accidents, while it never occurred to us to see what we could do to prevent the accidents in the first place. If we can stop people from getting sick we won't even need a pharmaceutical industry. Is this even worth considering?

Well, anyway, there's a lot of interesting things for me to talk about . . . and next to talking about me, talking with you over the air comes a close second.

Spread Spectrum Primer

Continued from page 32

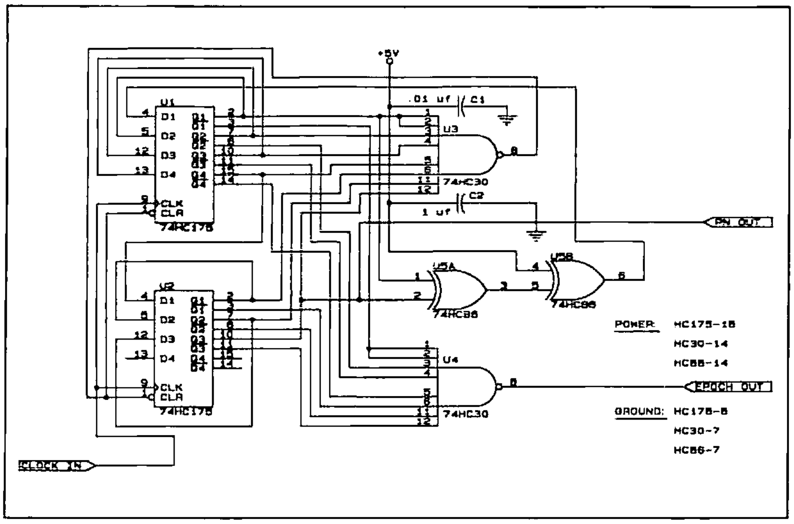


Figure 1. Simple 7-stage PN generator.

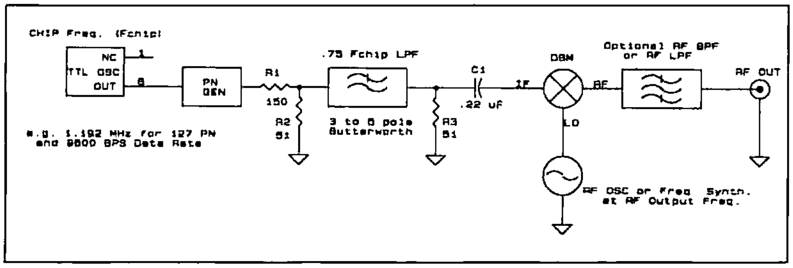


Figure 2. Filtered BPSK modulator block diagram.

Use of dedicated PCs or Macs with SS radios will be necessary until an integrated and well-defined data communication interface set of standards have been generated (commercial work along this line is being done by the IEEE 802.11 committee—hams haven't started this effort yet). The major feature that an industry standard hardware/software interface provides is a very simple and flexible way to channel (or multiplex) diverse sources and sinks of data to/from SSradio equipment. Standard PC or Mac (Appletalk) based multiple COM channel boards are being integrated into commercial SS radio host PCs and message routing software can be easily modified to handle multiple async data rates and protocols.

Are We Hams Ready for SS?

A very important part of a foreseeable nationwide spread spectrum system is the ability of the spread spectrum system to interface with other existing packet-based terrestrial and/or satellite-based or other amateur radio communications facilities. Several communication switching centers (or gateways) could be installed at various points throughout the US to handle digital voice, fax, teletype or other communications that require routing outside a national spread spectrum network or national ham radio PCN/PCS. Standard ham communications traffic and protocols could be transparently handled via these gateways. Will SS techniques have any impact on ham radio in the near future? Probably not—unless a renewed phase of ham radio experimentation takes place. Personal computers are now a fact of life in ham radio. So is packet. Will SS become old hat and used every day, like VHF/UHF SSB is? Time will tell. I think SS is one of the bigger challenges for hams—with ingenuity and dedication hams may enter the 21st century using SS and keeping most of our bands out of the hungry commercial interests' hands.

HOW TO GENERATE A LEGAL FCC PN CODE

Here is one tried and true (almost foolproof) Pseudo Noise (PN) generator circuit that requires no EPROM or PLD programmer (or software either.) The main advantage of this design is that it generates a seven-stage, length 127 maximal length shift register sequence that is legal to use under current FCC Part 97 amateur radio rules.

Simple, short length (four- to 13-stage) maximal length shift register (MLSR) sequence generators are often used to provide simple PN code generators for SS systems. These simple generators usually perform very well when started from the correct initial conditions or when reset at power up. However, most of these simple circuits can hang up and stop generating anything (they can get stuck) when an all ones (or an all zeroes) condition occurs. Which condition that causes hang up or how it got to this condition is immaterial—the darn thing is broken when this happens! The circuit concept shown in Figure 1 solves this problem very nicely and even includes an EPOCH sync detector as well (for data timing, scope sync, or whatever).

The circuit of Figure 1 is built from two 74HC175 shift registers, one 74HC86 and two 74HC30 NAND gates. As shown, the generator uses feedback from the last shift register stage as well as from the first shift register stage, as the FCC requires. This connection, when started from the all-zeroes state, will always generate the correct MLSR sequence. The top NAND gate looks for the occurrence of an all-ones condition (an indication of being stuck) and resets the shift registers to all zeroes if this condition should ever occur. The bottom NAND gate detects the occurrence of the all zeroes condition which marks the start of a PN cycle of length 127, also known as a PN EPOCH. The EPOCH signal is coincident with the start of the code repeat cycle and is useful for sampling or synchronizing input data for Direct Sequence Spread Spectrum (DSSS) modulation.

HOW TO GENERATE A USEFUL BPSK SIGNAL

Figure 2 shows a block diagram of a BPSK modulator that is useful on the ham bands. Spectrum limiting (both pre-modulation and RF bandpass filtering) is included in this design. As the unfiltered BPSK spectrum photo shows, Spread Spectrum BPSK is a relatively wideband modulation that can splatter out of a band. Pre- or post-modulation filtering must be used for most ham applications.

The clock for the PN generator, shown in Figure 1, is derived from a TTL crystal oscillator. This furnishes the "chip" clock signal. The chip clock must be 127 times the data rate for proper operation with this PN generator. The PN generator's output drives an impedance matching circuit, then a passive LC, a three- to five-pole Butterworth low-pass filter. This filter uses a cutoff frequency approximately 0.75 times the chip clock rate. This filter is used to "round" off the sharp edges and spikes that are present on the TTL output of the PN generator. This filtered, AC-coupled signal then drives the IF (DC-coupled port) of a doubly-balanced mixer (DBM). The LO port of the mixer is driven by a crystal oscillator-multiplier chain or a frequency synthesizer to provide an RF carrier for the modulator. Finally, the mixer's RF port drives a bandpass filter to provide the modulator's output RF signal. Optionally, just an output low-pass filter that reduces transmitter harmonics can be used instead of the bandpass filter. Further amplification and frequency conversion, if needed, comes at this point in an amateur radio SS transmitter.

SPREAD SPECTRUM GLOSSARY

AJ	Anti-Jam—designed to resist interference or jamming.
BPSK	Binary Phase Shift Keying—digital DSB suppressed carrier modulation.
CDMA	Code Division Multiple Access—a way to increase channel capacity.
CHIP	The time it takes to transmit a bit or single symbol of a PN code.
CODE	A digital bit stream with noise-like characteristics.
CORRELATOR	The SS receiver component that demodulates a spread spectrum signal.
DE-SPREADING	The process used by a correlator to recover narrowband information from a spread spectrum signal.
DIVERSITY	Sharing a signal characteristic to allow more users in the same frequency band.
DPSK	Differential Phase Shift Keying—a simplified BPSK where only data transitions are transmitted.
MULTIPLE ACCESS	A method for accomodating more users in the same frequency band.
NARROWBAND	A signal whose bandwidth is on the order ol its information bandwidth.
NOISE-LIKE	Having properties that cause the appearance of true random noise.
PCN	Personal Communication Network.
PCS	Personal Communication System.
PN	Pseudo Noise—a digital signal with noise-like properties.

Number 23 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

From the Mailbag

A few months ago, I relayed the plight of Bill Barbee AA5ZR, who was having trouble getting his Commodore computer to print when receiving RTTY online. I guess sometimes it pays to clean your desk because there, buried under more stuff than I care to discuss, was an old letter which addresses a similar problem. This one, though, comes with a solution.

Written to me several years ago by Carl Moore W4MJK, it discusses a problem with printing with Commodore computers. He said that the Kantronics Hamsoft protocol is compatible with printers. The Control-P key toggles the printer on and off with this software. Similarly, Kantronics Hamtext supports a printer toggle with the F7 function key.

He also indicated that his Star 10X printer, with a Cardco +G interface, was also not working at first. After checking everything "umpteen" times and still finding nothing wrong, he began to curse at the printer, and suddenly it began to print. There was a buffer in the setup which had to fill before printing would begin. This apparently applied to both sending and receiving.

His other suggestion was to connect the printer to the user I/O port on the computer. Figure 1 details the connection of a Centronics-compatible printer to the user port. The D0 through D7 lines are the data lines, and the corresponding lines are connected to the printer. It is important to use the signal ground, not the chassis ground.

It's worth a try, if you haven't already done it. Anyway, if it works, or helps, let me know.

I am passing this information along because it is related to another letter, just received, on the same topic. R. D. Carter, an SWL in Vass, North Carolina, states that he is using the Commodore C-64 computer and Kenwood R-600 and R-5000 with the MFJ-1225 receive-only interface and the AEA SWLtext software on ROM to receive CW, Baudot, and AMTOR/SITOR.

He had the exact same problem as AA5ZR: The C-64 would print on the monitor and be saved to floppy disk, but not print on the MPS-801 printer. He contacted AEA and was told that the MPS-801, to the best of their knowledge, could not be made to print RTTY in real time, and that this cannot be changed.

He solved his problem by selling the MPS-801 and purchasing a printer with a parallel Centronics input. He also purchased a Cardco+G serial-to-parallel interface to run the parallel printer from the C-64 serial output. R.D. notes that while Cardco sells more expensive interfaces, he believes that they will not do the job as well as the less expensive +G interface.

Apparently, this information was known to AEA as well, as they did tell R.D., in a letter two years ago, that as far as they know, the Cardco +G interface is the only one that will print real-time RTTY. He also passes along the information that Supra Corporation manufactures the Cardco interface. Orders may be phoned to (503) 967-9075; the tech support number is (503) 967-9081.

This information from R.D. Carter is provided pretty much "as-is," and I can't speak about the specifics, other than to say that it is provided in good faith. If you call Supra, be sure to tell them where you read about them, and if you apply this information to your own setup and have any measure of success, please let me know! Sure, tell me about your failures, too!

Moving back in time, so to speak, I received a letter from Jerry Arnold WA6MBP of Terre Haute, Indiana, who has a long-standing love affair with RTTY. He writes that the "August column was at least partially the *most* enjoyable for quite some time due to the admission that a few of us 'oldtimers' still get enjoyment from operating RTTY on *mechanical* machines. I am still using a good ol' Model 19, which is older than I am.

"Yes, it's noisy. Yes, it is limited to 60 wpm Baudot. But I don't care! In a recent RTTY QSO on 20 meters, the ham on the other end sent me his 'BRAG LIST' (no doubt dumped from a memory) and asked what I was using. I reached for my *REAL* BRAG TAPE (as punched by my own unit) and sent it out merrily at 60 wpm. The last entry on it says ' . . . AND THE TELETYPE IS A GOOD OLD MODEL 19.' When the ham on the other end responded, he said he ' . . . had never heard of that brand of computer!' Oh boy!!

"It is interesting to note that *some* software today designed for RTTY does not send a LINE FEED when a CARRIAGE RETURN is sent. That doesn't bother computer users, but it sure makes me keep my hand on the paper crank!"

I guess that last statement really is a plea for computer programmers to keep compatibility in mind—compatibility with mechanical teleprinters, that is!

Jerry also asks for some RTTY art to be included in the column. Well,

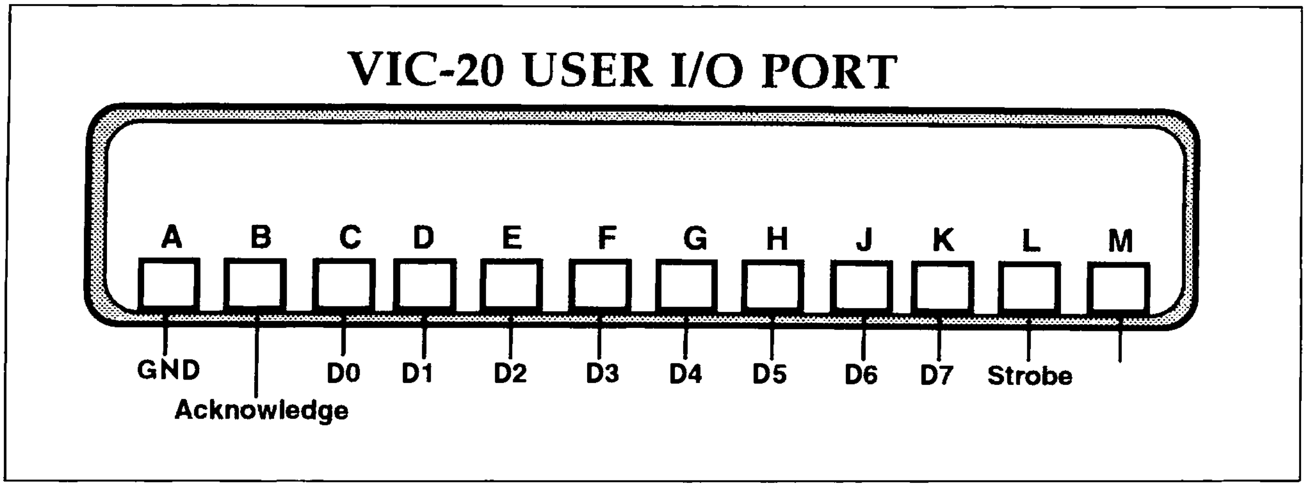


Figure 1. VIC-20 I/O port.

guys, send me some!

Stephen Coil KK6RB of Santa Ana, California, relates that he has been a subscriber to *73 Magazine* for about two years, and has gotten interested in RTTY. He wants to get onto RTTY with his computer, an Apple II+, but all he gets are blank stares and the response, "Software for that dinosaur?" Well, while he feels stuck in the Stone Age, Stephen wonders if there still exists some software for his Apple-saurous.

One popular program we mentioned a few years back was MODEM MGR. Used by many hams for years, this is one of the most comprehensive and well-supported programs available for the Apple II+, IIc, Iie, or IIgs. It supports split screen operation or full screen, at speeds to over 19k baud, and will run under either ProDOS or Apple DOS 3.3.

While Apple users sometimes feel orphaned by the amateur Industry, they are often reluctant to give up their machines and the sizable investments they have already made. For many, MODEM MGR speaks to that need precisely. It is available from MGR Software, Suite 101, 305 So. State College Blvd., Anaheim CA 92806. Contact them for current pricing and availability information, and be sure to mention *73*'s "RTTY Loop" when you write.

Another solution available to you would be to use any of a number of hardware solutions, such as the multimode interfaces from MFJ, Kantronics, or AEA, with a communication package. This would have the advantage of offering more modes and features, although it certainly would cost more. There are a variety of "boxes" out there, and you pays yer money and takes yer choice.

I look forward to hearing from each of you about these and related topics. Reach me by mail at the above address, on CompuServe at ppn 75036,2501, or on Delphi or America Online using the screen or user name MARCWA3AJR. And as we all sit down this month to observe the Thanksgiving holiday, let us think of those less fortunate than ourselves, whom we can help this time of year. This past few months have seen hurricanes, earthquakes, fires, and human destruction throughout the world. Maybe if each of us offered just a little kindness, we could help illuminate the darkness.

Number 24 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

While listening to the Tri-State Emergency Net originating from the K1XR "Keene Machine" in Keene, New Hampshire, my ears perked up when "Newsline 92" reported that the FCC has established Proposed Rulemaking Document 92-167. I did not get all of the particulars noted but it appears that it addresses the ability of licensed amateur operators from other countries to operate in the United States even though we may not have reciprocal agreements with them.

It appears that those wishing to operate in the United States would contact a Volunteer Examiner group which would check licensing documentation and administer a test. Upon successful completion the applicant would receive a Certificate of Successful Completion which would allow for 60 days of operation in the U.S.

I have not really had time to think of the pros and cons of this Proposed Rulemaking but will say that anything that a country can do to assist amateurs from other countries to operate in its own is a plus. Many of us have had the good fortune to meet many nice people from other countries on the air and then in person.

It is also very noteworthy to mention the agreement between Japan and the Republic of Korea (ROK). Catch that in "Roundup" under the Japan banner.

Another interesting way to license operators from other countries was performed by three ARRL VEs by "taking the mountain to Mohammed." Be sure to read this story in "Roundup" under the USA/Russia/Ukraine banner.

Now it is time for the news from the rest of the world.—Arnie N1BAC.

Roundup

Japan *From the JARL News:* **Reciprocal Agreement Between JA-HL!** August 1, 1992, is a memorable date for both Korea and Japan because the much-talked-about and long-awaited reciprocal agreement between the two countries came into effect.

Up to now, when a ROK citizen wished to operate amateur radio in Japan he/she was obliged to obtain an operator's license in Japan, using a club station. Henceforth, however, and thanks to results emanating from the two countries' agreement, the establishment of individual stations will be acceptable. And furthermore, it also will be possible for a ROK citizen to operate an amateur radio station on the basis of qualifications obtained in the ROK.

It is to be noted that with regard to the correspondence of amateur qualifications between the two countries, the first and second classes of ROK will correspond to the same of Japan. However, the third class (telegraph) of the ROK will be equivalent to the third class of Japan and the third class (telephone) of the ROK will be equivalent to the fourth class of Japan.

And finally, congratulations to all concerned!

Worked All Squares Award JARL has introduced a new award, "WASA," which is characterized by the use of the grid square locator system that is getting more and more popular worldwide.

This system enables us to clearly determine a location both on land and at sea. Therefore, QSL cards obtained through communication with locations at sea can also be used for the Award.

Seeing that this is our first attempt at this new system, we ask for your close cooperation and look forward to receiving your applications. There are two awards: WASA-V.U.SHF (achieve communication or reception with amateur radio stations in 100 different squares on and above 50 MHz and/or an amateur satellite; sticker for each 50 above 100) and WASA-HF (achieve communication or reception with amateur radio stations in 100 different squares using frequencies on and below 28 MHz; sticker for each 50 above 100). QSL cards are valid on or after July 1, 1992.

For further information write to: The Japan Amateur Radio League, Inc., Award Desk, 14-2, Sugamo 1-Chrome, Toshima-ku, Tokyo 170, Japan.

CQ Korea is the name of a new amateur radio magazine in the Republic of Korea. This B5-sized publication of 62 pages has a colored cover and a great many of the inserted photos appear in color. It sells on the local market for 2,500 won per copy, but the subscription rate is 25,000 won for one year (including postage) for domestic (HL) readers, plus a bonus of a free copy for the first two months.

Detailed terms for overseas readers have yet to be announced but should someone wish to subscribe, he or she is asked to write directly to: *CQ Korea*, Seoul-shi, Jongro-gu, Kyeonun-dong 47-1, Kongukyu Bldg. 312-1 Ho, Republic of Korea.

Scotland From the Scottish Tourist Board (Radio Amateur) Expedition Group, John "Paddy" McGill GM3MTH: On November 30th GB6SA will be operating on St. Andrews Day, celebrating the 2nd Annual International St. Andrews Day, involving the Moscow Radio Club (MTI) and the St. Petersburg Radio Club, and the Aberdeen ARS. The callsigns appear to be GB6SA, R1SA, UA3 or RA3???, and GBØASP.

This appears to be the last of the List of Events of 1992 for the Scottish Tourist Board (Radio Amateur) Expedition Group. Correspondence for awards should be addressed to Awards Manager, Robbie GM4UQG, P.O. Box 59, Hamilton, Scotland, ML3 6QB, and correspondence to Paddy should be sent to John (Paddy) McGill GM3MTH, 9, Ramsay Place, Coatbridge, Lanarkshire, Scotland, ML5 5RE.

USA/Russia/Ukraine *From the Roanoke Times & World News, Saturday, August 1, 1992, sent to us from David Larsen KK4WW:* "In a small room in the east wing of David Larsen's hilltop house are some of the keys of global goodwill and understanding. They're on a computer that's hooked to an array of amateur radio gear. Larsen has been using those keys for more than a year to communicate with people in the former Soviet Union. Amateur radio operators in the old Soviet republics have been included in this computerized ham radio project." Larsen has developed many friends in the Ukraine since meeting Victor Goncharsky, an amateur operator, during a ham convention in the US during 1990. David and his wife Gaynell, also a ham, have visited republics in the former Soviet Union during the past three years. They and others have taken a new IBM-donated computer plus several older but serviceable PCs there as a first step in setting up an emergency radio communications network.

The development of this network will allow those republics to maintain emergency contact with each other during times of emergencies and will allow peaceful communications around the world during the rest of the time.

The transfer of these computers has been made possible by building

Photo A. Diploma Islas Canarias.

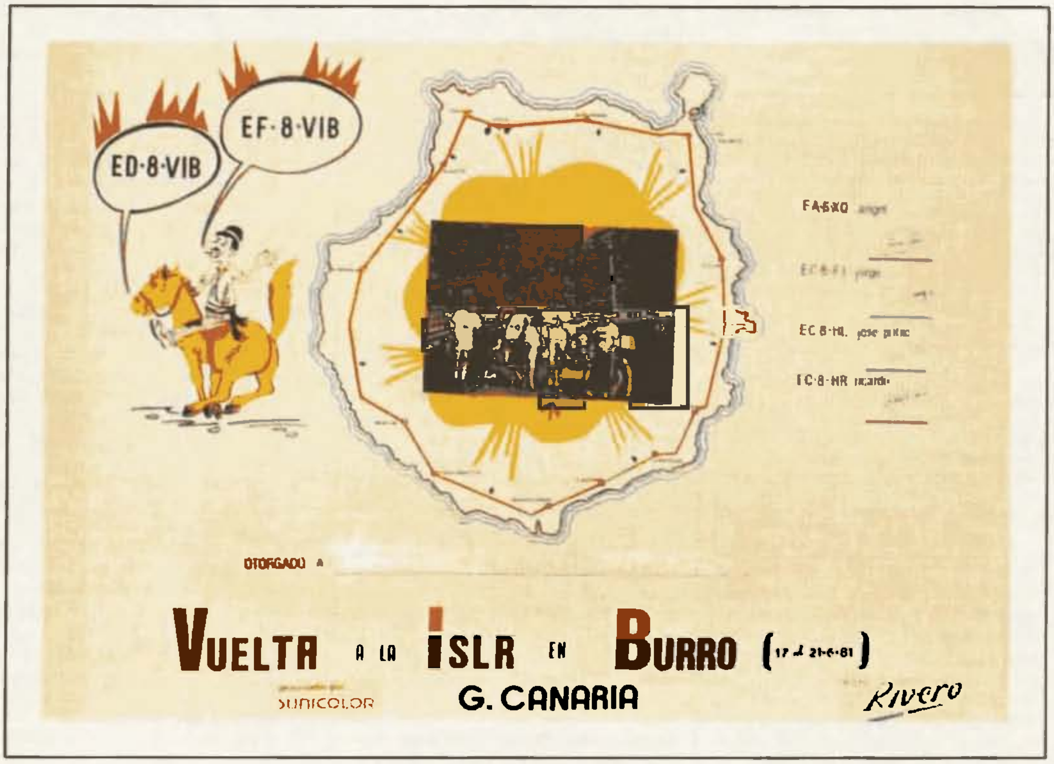


Photo B. The EA8VIB QSL card.

an organization called the Foundation for Amateur International Radio Service, or FAIRS, with David Larsen as the executive director. When these computers are connected to ham transceivers, the computers can send and receive a form of radioteletype that is less affected by atmospheric conditions and is automatically error-correcting, making it highly accurate and more efficient than Morse code. The computers can also save and store messages for later retrieval. *[A phone call to David confirms AMTOR using the APLINK program connected to a BBS.—Arnie]* The Larsens were visited by Vyacheslav Sergeev and Yuri Katyutin earlier this year and if plans work out, Victor and Helen Goncharsky from the Ukraine will visit in August. Helen served as an interpreter during the Larsens' visits to Russia and Ukraine. These visits are part of an exchange agreement between Russia's Ulyanovsk Polytechnical Institute and Virginia Tech, where David teaches chemistry.

Ukrainians and Russians receive USA Amateur Licenses! The FAIRS group gave ARRL VEC exams in the Ukraine and Russia during the May 1992 visit of American FAIRS members. The ARRL VEs were David Larsen KK4WW, John Douglas NØISL, and Victor Goncharsky KC1VF. Victor's home call is UB5WE in Lviv, Ukraine, and he received the American call during a visit to the Dayton Hamvention in 1990. The exams were given to eight in the Ukraine and four in Russia, and a total of six passed the exams.

During the visit David and Ron taught workshops on instrument automation and local area networking. David also worked on university exchange agreements for VPI and SU and several institutes in Russia and the Ukraine. The group spent as much time operating from Lviv, Ukraine, and Ulyanovsk, Russia, as possible.

For more information on FAIRS and the trips, contact David or Gaynell Larsen at (703) 745-4023 or 231-6478, or write P.O. Box 341, Floyd VA 24091.

"It appears that those wishing to operate in the United States would contact a Volunteer Examiner group which would check licensing documentation and administer a test."

CANARY ISLANDS SPAIN

Woodson Gannaway EA8/N5KVB
Apartado 11
35450 Sta Madre Guia (G.C.)
Islas Canarias
Espana

[This letter was sent prior to the FAX received from Woodson in time for last month's Spanish lesson. It will hopefully clear up some of the info from last month.—Arnie] The newspaper that I read today says that in October 1992 we will have a World Amateur Radio Congress here in Las Palmas de Grand Canary! It says it will be in the Imperial Playa Hotel and will attract hundreds of hams from all over the world. The editorial continues to say that this convention hasn't been publicized either by the local or national authorities.

My one-man project to at least document the unique Canary Islands knife style (before it died a quiet death from neglect) is beginning to bear fruit after four years of gardening and mothering. After a brief preview in the yearly "Knives '92," it will be featured in an article in "Knives '93." Those of you interested in that sort of thing might enjoy reading it. To say that I've had a fine time doing it (working with an old-world master smith to learn how to make the knives so I'd know what the *@$# I was writing about) would be a real understatement. It is a comment on the sad state of our world that I don't know where I can sell an article about the human interest side of the story, by far the most interesting facet of all. Occasionally he asks me: "How long is it that you've been the shop now? What, four years? It seems like it was just the other day . . ."

I also enclose the Diploma Islas Canarias (Photo A). This diploma is awarded to amateur radio operators and SWLs in all parts of the world for having contacted different EA8 stations after April 29, 1971, on any band or any mode. The requirements are: for Spain, Portugal, Madeira—contact 60 different EA8 stations; the rest of Europe and Morocco—40; South America and the Caribbean—30; USA, Canada, and Africa—20; and Asia and Pacific—10. It is not necessary to have received QSL cards; just send a list of the EA8 stations contacted, in alphabetical order, and indicate date, band, and mode of the contact.

The request needs to be signed by two amateur radio operators, stating that they have checked the logbook of the petitioner. Send 15 IRCs with the list to: Diploma Islas Canarias, Apartado 860, Las Palmas de Gran Canaria, Islas Canarias, Espana.

Also enclosed is the QSL card sent to operators contacted during our "Expedition Around the Island" on Burros (Photo B). *[What will hams think of next?—Arnie]*

SOUTH AFRICA

Hans van de Groenendaal ZS6AKV
SA AMSAT
PO Box 13273
Northmead 1511
South Africa

IARU Station Established at National University of Lesotho. On Friday, August 21, the IARU Region One Working Group for the Promotion of Amateur Radio in Developing Countries presented a complete HF amateur radio station to the Amateur Radio Club of the National University of Lesotho as part of its programme to establish amateur radio in the developing world.

At the ceremony, which was attended by senior government representatives, university personnel, and the secretary of the Lesotho Amateur Radio Society, the IARU PADC liaison officer, Hans van de Groenendaal ZS6AKV, said the establishment of the Radio Club at the National University of Lesotho was an important step to place amateur radio on a firm footing in this African mountain kingdom and would provide the infrastructure to teach Lesotho youth amateur radio. From an educational point of view this will add a third dimension to the teaching of science and in particular electronics and communications.

"Amateur radio," he said, "provides an opportunity to get Lesotho's youth interested in electronics and pursue a career in this field. For Lesotho itself it is another step forward in training local people in this growth sector where the country is currently almost totally dependent on imported personnel." The Managing Director of the Lesotho Telecommunications Corporation, Mr. L. Mohapeloa, said that his corporation supports this new thrust to establish amateur radio on a more local footing and said that he was committed to easing regulations to make the hobby more accessible to the youth of his country.

Number 25 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

Deadline for the December classifieds is October 12, 1992.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. Affordable Electronic Repair, 7110 East Thomas Rd., Scottsdale AZ 85251. (602) 945-3908. BNB220

FINALLY HEAR those unreadable signals buried in noise, heterodynes, tuner uppers. The **REVOLUTIONARY** new JPS audio filter NIR-10, digital signal processing, simple hook up, deep discounted $329.95 delivered! Authorized dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR. Orders: (800) 484-4002, code 1356. BNB254

QRP KITS IN CANADA! CW Transceivers, Receivers, Morse Keys, and more. Details: "CQ RADIO KITS," Box 1546, Bradford, Ontario. L3Z-2B8 CANADA. (416)-775-9119. BNB433

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REVOLUTIONARY HYBRID AERIAL WIRE: 168-strand copper "FLEX-WEAVE" Tm, #14, strong, Ultra Flexible, ties in knots, nonstretch, won't rust/kink like copper weld, $36.95 first 275' (minimum), $.13/ft. thereafter, includes shipping! (Radial wire only.) Catalog $1.00. DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB557

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WANTED: ROBOT 1200C in excellent electrical condition. MUST HAVE SCOTTIE 3.6 EPROM. Call sign irrelevant (SWL use only). Simon 609-663-5362. BNB701

RIG REPAIR by 20-year ham. Fast, reasonable. Skip Withrow, 5404 S. Walden Street, Aurora CO 80015. (303) 693-0997. BNB702

IBM PC VIDEO DIGITIZER 640 BY 480 **RESOLUTION.** 256 gray levels, $89.98. Demo disk, $3. Information, $1. Colorburst, Box 3091, Nashua NH 03061. BNB703

ROSS' $$$$ NEW November (ONLY): KENWOOD TM-411A $300.00, TH-315A $280.00, TM-241A $355.00, TR-8400 $330.00, ICOM 04AT $250.00, 735 $920.00, 471A $850.00, TEN-TEC 535 $1150.00, 222 $27.00, 238 $319.90, TELEX HYGAIN 395S $400.00, 390S $240.00, 500 FT RG-213 $150.00, YAESU FT-709R $275.00, FT-73RTT $250.00, FT-470 $345.00. YAESU PRICED WITH COUPON. ALL LIMITED TIME OFFERS. WANTED: MANAGER SALES PERSON FOR NEW STORE. SEND RESUME TO P.O. BOX 234. Over 9,000 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB707

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MINIATURE POLICE RADAR TRANSMITTER one mile range, $41 assembled, $31.00 kit, (219) 469-1711. P.O. Box 80096, Fort Wayne IN 46898. BNB725

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WANTED: HAM EQUIPMENT AND OTHER PROPERTY. The Radio Club of Junior High School 22 NYC, Inc. is not only the Big Apple's largest Ham club but also the nations only full time non-profit organization working to get Ham Radio into schools around the country as a theme for teaching using our EDUCOM-Education Thru Communication-program. Send your radio to school. Your donated amateur or other property, which will be picked up or shipping arranged, means a tax deduction to the full extent of the law for you as we are an IRS 501 (c) 3 charity in our twelfth year of service. Your help will also mean a whole new world of educational opportunity for children around the country. Radios you can write off, kids you can't. Please, write, phone, or FAX the "22 Crew" today: The RC of JHS 22, POB 1052, New York NY 10002. Telephone (516) 674-4072 and FAX (516) 674-9600. Young people, nationwide, can get high on Ham Radio with your help. Thanks for reading and helping! BNB762

ELIMINATE MULTIPLE NOISE TONES in your receiver audio output. The revolutionary new JPS notch filter, model #NF-60, Digital Signal Processing simple hook up. Unlike other Notch Filters, notches out multiple varying tones. **Deep Discounted:** $139.50 delivered continental U.S.! (Elsewhere $150.00 plus shipping.) Authorized JPS dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR orders: (800) 484-4002, code 1356. BNB763

SOLAR POWERED HAMS! The Sunswitch is a charge controller to protect your batteries from over charge. Power MOSFETs are used, no relays! Assembled tuned and tested $39.95 plus $2.50 shipping. Sunlight Energy Systems, 2225 Mayflower NW, Massillon OH 44647. BNB774

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Number 26 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

I'm bored. I've got a coupla' new antennas that I keep meaning to put up, but I never seem to get around to it. I've got a transceiver kit sitting on my desk, still in the shipping box. I can't remember the last time I turned on the 2 meter transceiver in my car. I took the HF antenna mount off my car a few months ago and haven't needed to re-install it. My multimode controller hasn't multimoded in weeks. There's a layer of dust on my HF gear that really should be wiped off.

Ho hum . . . I'm in the dreaded amateur radio rut.

I have no one to blame for this apathy but myself. After all, amateur radio isn't a single hobby, it is hundreds of specialized interests all held together by the common thread of the Amateur Radio Service. If you get bored with one, there's always something new to try.

Let's see . . . what haven't I tried yet? How about ATV? I've always wanted to put together some video presentations—sort of "mini-documentaries"—and transmit them to other hams. Wouldn't it be great fun to get together every week and show off your latest video creation to other ATVers? We could share other hobbies, careers, or even short fictional stories. With the activity on 450 MHz, everyone who has a cable-ready TV or VCR already has an ATV receiver. A low-cost transmitter, a simple antenna, maybe a preamp to boost the received signal, and I could be in business!

Something else I've always wanted to try is foxhunting. I've already got a portable beam. All I'd need to do is wire up a simple attenuator and some kind of signal strength meter, and I'd have a pretty good beginner's foxhunting rig. Make a few calls, invite some friends over for a Saturday foxhunt/barbecue. I've got a coupla' hundred acres of State Forest bordering my back yard that would make a great place to hide the fox. Now that sounds like fun!

What about QRP? Sure, I've dabbled in low-power contacts, but how about working all 50 states on a 5-watt rig I build myself? Might even be fun to get back into CW operation. I do so much traveling, I could bring a QRP rig, antenna and code key with me and get the first "Worked All States—Hotel Portable" award in the history of amateur radio! It wouldn't cost much, either. Ramsey's got a nice little transmitter/receiver combo for less than $100. There are a bunch of other advertisers in *73* with nice QRP transceiver kits for very little money.

Something else I've never done is microwave operating. I bet I could work nine or 10 states, plus a few Canadian provinces, all from the top of Mount Washington (6,300 feet) in northern New Hampshire.

Speaking of northern New Hampshire, aren't there a few rare counties up there? I already have the HF mobile gear. It would only take about 10 minutes to mount that Outbacker back onto my car. In fact, Outbacker has a new model coming out, and Douglas RF Devices has an all-band mobile antenna I'd sure like to test drive. I've never really gotten involved in county hunting, but it sure would be neat to be on the receiving end of a pile-up.

I haven't done any public service in quite awhile. With my new pilot's license, I wonder if my skills as an amateur radio operator would be valuable to the local Civil Air Patrol wing? That would be one way to combine two interests, while putting both to good use. One of the CAP's functions is to locate downed aircraft, often by radio-direction-finding the emergency locator beacon contained in most every aircraft. Talk about a foxhunt!

Satellites is yet another area of amateur radio that I have very little experience with. I hear that now it's easier than ever to get involved. I bet I already have all the gear I'd need to get started. I could download some tracking software for my Mac off of an online service, get the current orbital data off of the local packet BBS, and I could be on the air via satellite in a single afternoon.

Something else that piqued my interest recently is the possibilities of remote base operation. I met a guy at the Los Angeles hamfest who could do everything—and I mean *everything*—from his 2 meter HT. He could change frequency and band (with verbal confirmation of the change), switch between different antennas and rotate his tribander (again, with an automated voice confirming the new heading). He did all this via the tone pad on his HT. We were sitting by the hotel pool, and he was making DX contacts on 20 meters through a shirt-pocket-sized radio! I know this isn't exactly new technology, but it was the best application of remote operation I had ever witnessed. Let's see . . . my house sits at the crest of a 900-foot hill, with a clear shot to almost every direction (except when I drive behind the few higher hills and mountains). A nice high mast at the peak of my roof would get my antenna higher by almost another 100 feet. Maybe I ought to give that guy a call.

I guess I'm not really in a rut at all! In fact, I don't know what to do first.

Hams often call amateur radio "The Greatest Hobby In The World." Even though we may be a bit biased, there is a lot of validity to that immodest claim. I set out to outline the various subgroups of amateur radio activity the other day. I stopped after three single-spaced pages and probably could have come up with two or three more pages without much trouble. "Amateur" and "radio" are two simple words that we use to define literally hundreds of unique and fascinating activities. When you combine amateur radio with other areas of interest—aviation, camping, boating—I'd bet the list would grow to the thousands.

There's one more thing I've been meaning to get to, and I think I'll put it at the top of the list. My neighbor's 10-year-old son was watching me put up a 2 meter quad last weekend. Ya' know, I've been meaning to move that 80 meter dipole, and I think I'll ask him if he'd like to help me get it back into the trees. Then, when we're done, I wonder if he'd like to get a chance to say hello to someone across the ocean? I bet I know what his answer will be. 73

Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

November is a month that falls between the excellent fall propagation conditions of September/October and the relatively poor winter conditions of December/January . . . which is to say that the HF bands will be trending from Good to only Fair as a general prediction and that many days during the month are expected to be Poor.

For example, the periods between the 5th and 7th and again between the 10th and 14th are anticipated to bring not only poor inonospheric propagation but also the possibility of some severe weather in some parts of the country, and maybe even other geophysical effects as well. There are several significant planetary alignments during that period which historically have produced some very "interesting" results in the past. Look again for poor conditions around the 23rd to 25th and again around the 29th and 30th. This means about 10 days out of 30 that are forecast to be "Poor." The daily forecast will tell you what to expect.

Use the band-time-direction chart for your planned activities and DX operation. I wish I could say that the propagation will be good all month, but that just won't happen.

In general, the bands above 20 meters will close at dark or before, while those below 20 meters will become quite DX-lively. There won't be the summertime QRN to disguise weak signals, so you will be able to do very well on 30, 40, 80, and (possibly) 160 meters. As the later hours of night and the early hours of morning approach, the better the lower frequency HF bands become . . . so either get your sleep during the day or keep the coffeepot going. Finally, as dawn approaches, the higher HF bands will come alive and some excellent east-west DX and long-path DX will appear. Always use the dusk and dawn periods for "grey-line" DXing, too. I think that 20 will be the "sleeper" this month and may well be the best band of all . . . but will also provide the usual pile-ups and crowding . . . so a beam or "gain" antenna will be very helpful. You'll be able to hear the weak ones in there, and quite often the weaker stations will prove to be the real gems you need. Let me know how the month goes for you, too. I like the feedback.

By now you already know that the solar flux has consistently fallen below the 100 mark on many occasions since June and July—which is a "leading indicator" of the decline of cycle 22 and the approach of the sunspot minimum, so make hay while the sun shines. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15*	20	20	20	—	—	—	—	—	—	—	15*
ARGENTINA	15	15	20	20	40	—	—	10	—	—	10	10
AUSTRALIA	10	15	20	20	—	40	20	20	—	—	—	10
CANAL ZONE	15	40*	40*	40*	40*	—	20	10	10	10	10	10
ENGLAND	20	40	40	40	—	—	20	10	10	10	15	20
HAWAII	10	15	20	20	40*	40	20	20	—	—	—	10
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	15*	20	20	20	—	—	—	—	—	—	—	15*
MEXICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
PHILIPPINES	—	—	20	20	—	—	20	15*	15*	—	—	—
PUERTO RICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
SOUTH AFRICA	40*	20	20	20	—	—	—	—	10	10	10	15
U.S.S.R.	—	40	20	20	20	—	—	10	10	15	20	20
WEST COAST	10	15	20	20	[illegible]	[illegible]	—	—	—	10	10	10

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	20	20	—	—	—	—	—	—	—
ARGENTINA	15	15	20	20	20	—	—	10	—	—	10	10
AUSTRALIA	10	15	15	20	20	40*	40	20	—	—	15	10
CANAL ZONE	15	15	20	20	—	40	40	10	10	10	10	10
ENGLAND	—	—	—	—	—	—	10	10	15	15	20	20
HAWAII	15	15	20	20	40*	40*	40	20	—	—	10	10
INDIA	—	20	—	—	—	—	—	20*	15	—	—	—
JAPAN	10	15	20	20	20	—	—	—	—	—	—	—
MEXICO	15	15	20	20	—	40	40	10	10	10	10	10
PHILIPPINES	15	—	—	—	—	—	—	20	10	10	—	—
PUERTO RICO	15	15	20	20	—	40	40	10	10	10	10	10
SOUTH AFRICA	20	20	20	—	—	—	—	—	10	10	15*	15
U.S.S.R.	—	—	20	—	—	—	20	15	15	15	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15*	—	20	20	20	20	20	20	20	—	15
ARGENTINA	10	15	15	20	20	20	—	—	10	—	10	10
AUSTRALIA	10	15*	15*	20*	20	20	40	—	—	—	—	10
CANAL ZONE	10	15	15	[illegible]	[illegible]	—	—	—	15*	10	10	10
ENGLAND	—	—	—	—	—	—	—	—	15	20	15	—
HAWAII	10	10	15	20	40*	40*	40	40	15	15	—	15
INDIA	—	[illegible]	—	—	—	—	—	—	[illegible]	15*	—	—
JAPAN	10	15*	—	20	20	20	20	20	20	20	—	15
MEXICO	10	15	15	[illegible]	[illegible]	—	—	—	15*	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	—	20*	15	15	—
PUERTO RICO	10	15	15	[illegible]	[illegible]	—	—	—	15*	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	—	—	—	20	20	—	—	—	15	15	20	20
EAST COAST	10	15	20	20	[illegible]	[illegible]	—	—	—	10	10	10

* Try next higher band   () Difficult path

November 1992

SUN	MON	TUE	WED	THU	FRI	SAT
1 F-G	2 G	3 G	4 G-F	5 F-P	6 P	7 P-F
8 F	9 F-P	10 P	11 P	12 P	13 P	14 P
15 P	16 P-F	17 F-G	18 G	19 G	20 G	21 G-F
22 F-P	23 P	24 P	25 P	26 P-F	27 F-G	28 G-F
29 F	30 F-P					

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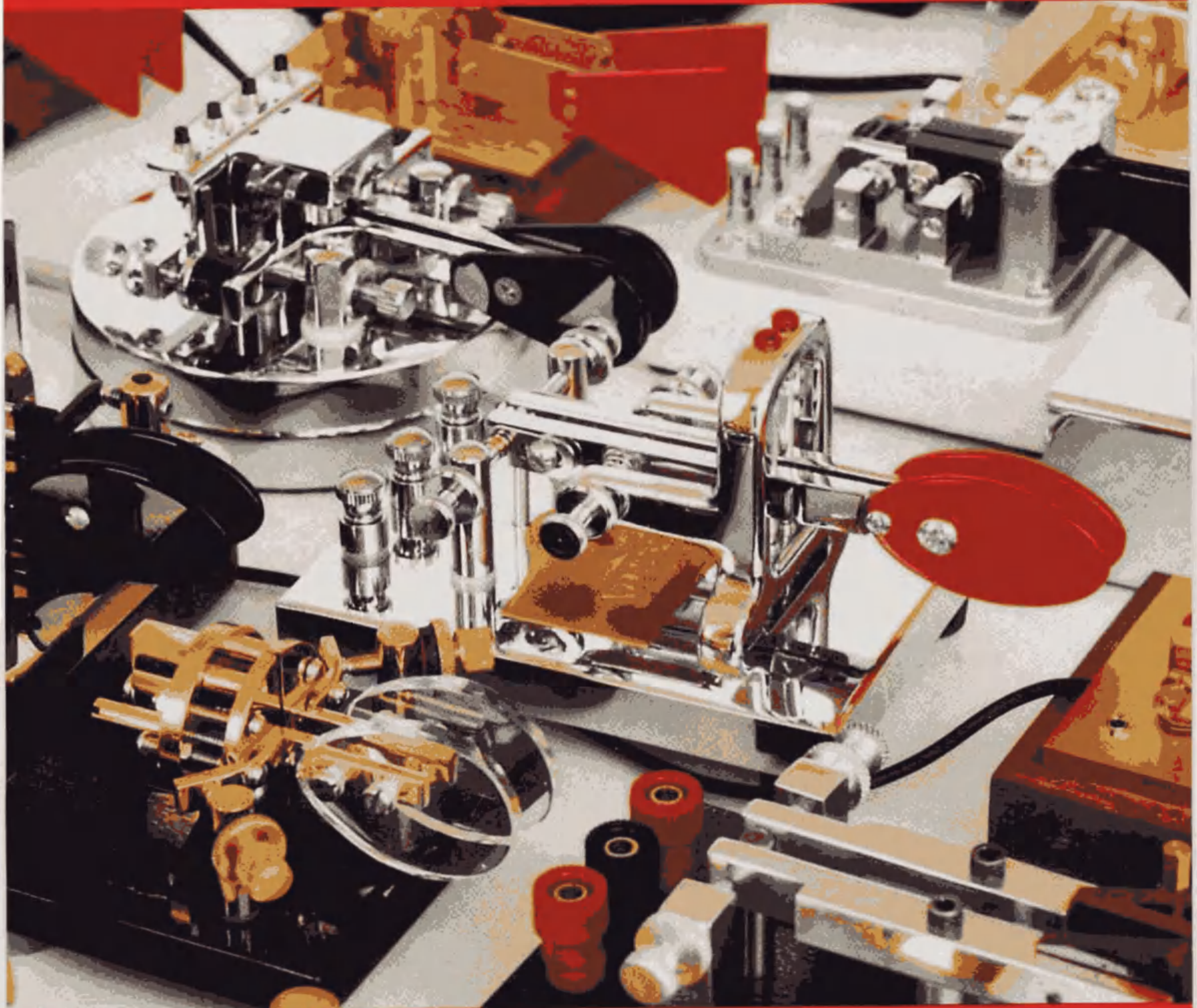

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73 Reviews

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LETTERS

Number 1 on your Feedback card

From the Hamshack

Robert E. Weimer W5DPO, Albuquerque NM I just recently bought a 2 meter handie-talkie. In the vernacular out here, I "jumped off." And, it was deja vu!

In the 1950s I was "rock-bound." Crystals cost $3.99 each from Allied Radio in Chicago. And, once you got your rig on the air and standing by for an opening in traffic, it was wait . . . and wait . . . and wait.

Later came the Citizen's Band, with 23 channels. Just like being rock-bound again. Wait . . . and wait . . . and wait.

Now we have 2 meters with repeaters. Just like being rock-bound. And it's wait . . . and wait . . . and wait.

While waiting after I programmed the HT, I could listen to some of the conversations and I was fascinated that it seems the longer the years, the less the change.

"Can you pass some emergency traffic?" "Yes." While waiting for the emergency traffic to come, another station came on the air to gush how nice it was to meet at the picnic, what a lovely time was had by all, and on and on. I wondered if the person who was waiting for the emergency traffic to be passed was bleeding uncontrollably. Later, I checked the *Callbook* and found that the gusher was an Extra class licensee—which sums up that technical knowledge does not always come with common sense.

David Satterfield WB7VET, Carson City NV I read David Cassidy's "Random Output" column calling clubs who restrict Technicians from using their repeaters "prejudiced," "self-inflated snobs," with "zealous hatred" and "regressive, bigoted ignorance." He agrees that it is perfectly legal for them to do whatever they wish with their equipment, but in the same breath he encourages us to go on a witch hunt for him and ferret out these clubs and their officers so that they may be placed in the stocks of *73*'s town square and exposed as evildoers, despoilers of amateur radio! Which brand of bigotry and zealous hatred is worse, his or theirs?

This is more of the "I have rights and you must accept me as I am" mentality that is so prevalent these days. Which, when translated, more often than not means "I want it all whether I earned it or not!" I'm surprised that some Tech or Novice hasn't sued the FCC because they restrict his freedom of speech on 80 meters! I myself am a Technician. I happily work code and only sometimes use VHF. I would not open a vein if I couldn't use a repeater because I was a Tech. I might go out and get my General, something that takes more effort than griping! I heard of a club in my Novice days that you could join only if you could copy 50 wpm or better. How unfair! How dare these bigots not let me join their club and use their gear? Didn't a study show that the inability to copy code over 10 wpm is due to the right and left hemisphere's being slightly out of synch? We're developmentally disabled! My lawyer is salivating.

Mr. Cassidy, the Constitution does not guarantee anyone happiness. It guarantees the RIGHT to PURSUE happiness. In the private world this means you must EARN the PRIVILEGES that guarantee happiness. Amateur radio is a hobby. If you want more from the hobby then get better at it. If these whining Techs want more, then either upgrade (effort), or join another club (no effort).

David—When you talk to me about the Constitution you're preaching to the choir, but intolerance of bigotry and prejudice cannot be labeled bigotry itself. I firmly believe that we are only entitled to what we earn, but that doesn't excuse those who consider themselves "better" because of race, religion or license class. If we apply your twisted logic to other forms of bigotry, your advice to a black man who is excluded from a country club is for him to "become white," or perhaps women should "become men" in order to attend a business lunch at an all-male club. Your argument presupposes that Technicians are lesser beings and should be treated as second class hams. Do you feel the same about other races, religions and sexes?

Any ham club that openly discriminates against certain license classes should have no problem with us advertising that fact. If they don't feel comfortable with us listing them as a discriminatory club, then they must obviously feel there is no justification for their discrimination. You see, if you shine a light on a cockroach it runs and hides. If they don't have any qualms about what they're doing, they shouldn't have a problem with us shining a light on them. Some things are just plain wrong and discrimination, for any reason, is one of those things . . . David N1GPH

Dean Sanderlin N9ILO, Waukegan IL Well Wayne, you can take at least partial credit for getting someone else up and doing something productive: me. After 18 years of repairing things electronic, mostly commercial two-way equipment, and doing it while working for somebody else, I finally decided to start doing it while working for myself, as my ad in "Barter 'n' Buy" will attest. It finally sunk in after coming home from a local hamfest with a sick computer, the one I'm writing this letter on, and having it up and running the same afternoon. I asked myself why, with all this experience, shouldn't I be using it for my own benefit, and for the benefit of those who could really use it? With all the new operators, I believe competent service will be in demand. I would also like to share my experience. Like Willard Shears W2IOS ("Letters," May 1992), I would like to be able to teach troubleshooting to these newcomers or, for that matter, to anyone else who would care to learn.

I am not a relative newcomer to amateur radio, as my call might indicate. If you have a '66 *Callbook* you might find my name next to WN9UYJ. True, there is a large gap there, but I never got too far away.

About your editorials, Wayne: They are what got me to get up and get my ticket again. They are also what got me to finally decide to take this step in self-determination. I thank you.

Josh Kelly NØNPI, Ft. Dodge IA During the past few months I have heard a number of comments about the language and content of the QSOs on HF. This is giving amateur radio a very bad reputation. This is also the reason I have never worked HF and probably never will (aside from the ridiculous CW requirement).

I have also heard about a lot of CBers who are NOT licensed amateurs on 10 meters, running the Radio Shack 10m mobiles. Last night I heard something that really made me mad. A couple of local CBers who were talking on 10m mentioned that they were both going to Radio Shack in the morning to buy 2m HTs.

Then there was the group that I heard about on 80m. A No-Code Tech was talking to a group about how he had just received his license the other day and how he refuses to learn the code. Basically, he was telling the FCC where to go. While I am against code, I DO NOT advocate this type of operation. Face it: The code requirement is there and, until this changes, we have to live with it.

As far as the illegal use of 2m HTs is concerned, I think we should have some way to limit the sale of amateur gear. Yes, it would be a big pain in the rear to have to prove that you have a license every time you purchase gear from a commercial vendor, but there are a lot of other things in the world that are an even bigger pain. Besides, it would only take two seconds to show the salesperson your ticket.

I can hear you all crying now, "But what about new hams, those who have passed the test and are waiting for their ticket to come in the mail?" If they have the certificate showing that they passed, then they could purchase equipment. Sure, people could lie, or use someone else's license, but it would cut down on the problems. I just hope those who aren't licensed but who purchase 2m HTs decide to take the No-Code test. It only takes a week or so of studying to pass it.

Andrew H. Kilpatrick WZ8A, West Chester OH Wayne, with regard to the Baxter problem, you are totally correct, of course, both with respect to the FCC and the ARRL.

For your information, after twice requesting the ARRL's position on K1MAN/IARN and then sending in a blank renewal form which also requested an answer, Dave Sumner finally sent me some two-year-old *QST* clippings which joyfully proclaimed that the ARRL was not part of the "controversy." The sad thing is that I will probably rejoin that operation just for the outgoing QSL bureau.

As to your suggestion of generating anti-IARN broadcasts on frequencies frequented by Baxter's multi-channel transmitters: That should be effective, and with just the information we already have on IARN, several hours of interesting broadcasting should be possible.

There is one small problem, however. I believe that such broadcasts, in order to be at least as "legal" as Baxter's, should be made by a legitimate amateur radio organization. Certainly if WGI were to sponsor such an organization, it would be many times more legitimate than IARN. In any case, let's say the organization is called "NRAI"—not to be confused with the NRA—and is chartered to stop broadcasting interference caused by amateurs on the amateur bands (NRAI = No Radio Amateur Interference). Broadcasts would begin prior to IARN diatribes and informal nets would be encouraged after each broadcast to discuss the broadcast material. Scheduled broadcasts would continue (emanating from Maine or New Hampshire) until egomaniacal broadcasts on the amateur bands are voluntarily discontinued, or are outlawed by some attorney-type political appointee who "works" for the federal government.

So how about it, Wayne? Would WGE sponsor the amateur radio Information group, NRAI? (As sponsor, you can also select the name of your choice for the organization.) Please say yes, and I'll get the tape recorder rolling (I'm beginning to get that broadcaster's sense of power already!) and start looking for willing transmitters Down East.

Andy—It doesn't take much of an organization to be more legitimate than Baxter's IARN, which is made up largely of hubris emanating from Baxter. A name? Hmmm. Let's see . . . we might have the Radio Amateur International Network and RAIN on his parade. But if you're going to retransmit Baxter's bulletins you can do it as an official IARN news station . . . that's the Institute of Amateur Radio Network.

I originally formed the IAR in 1963 because we needed an official "organization" to contract for group travel. We took a group of 73 amateurs on a tour of Europe, with hamfests in London, Paris, Geneva, Rome and Berlin. We would have continued except for the ARRL's Incentive Licensing proposal to the FCC which brought the hobby to a screeching halt in 1964.

As the Secretary of the IAR I'd like to see cooperating radio amateurs improve Baxter's coverage by repeating his broadcasts . . . at least until such time as the IAR is able to provide endless information resources of its own.

If Baxter's transmissions are legal, then any repeating of them should be equally as legal . . . with appropriate identification as per Part 97. If our transmissions start before Baxter on 14.275, then K1MAN will be intentionally interfering with (jamming) our IARN broadcasts if he comes on.

The Institute is an honorary membership organization with no paid dues, so we're not soliciting any dues or donations . . . only service in the long-range interest or amateur radio . . . Wayne

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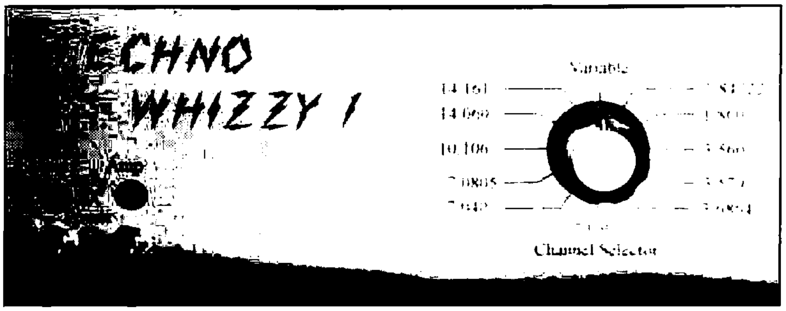
TABLE OF CONTENTS

FEATURES

REVIEWS

DEPARTMENTS



Build your own DDS radio . . . see page 8.

Cover: Keyer paddles from the collection of John Rehak N6HI. Cover photo by Jim Mintum N7YVK.

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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Audit Bureau of Circulations (ABC) membership applied for.

Contract: By merely glancing in the general direction of this miniscule message, you have just become legally obligated to the staff and management of *73 Amateur Radio Today* to introduce one young person to amateur radio within the next 30 days. Surely you have some youngster in your neighborhood, or perhaps a son, daughter or grandchild, who would be fascinated to learn about this hobby. It could be the greatest gift you could ever give them.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Thoughts At 70

My wife took advantage of the bargain airfares, so we celebrated my 70th birthday in Alaska. Other than a couple-hour stopover In Anchorage, this was my first real visit to Alaska, so I was looking forward to it. More about that presently.

There was a chart In *Time* which showed the life expectancy for people according to their birth year. It turns out that when I was born my model was scheduled to last an average of 55 years, so I'm already 15 years into overtime. No wonder so many of my old Navy and college friends are dead.

Since there's no way to gauge how far this overtime thing can be pushed and I don't notice Willard Scott being overrun with centenarian announcements, I'm going to do my best to stay healthy and cause as much trouble as I can with whatever time I've got left.

The Ketchikan 79 repeater provided a QSO with three locals; two were heading out of town for the weekend. I tend to somehow run into things like that, so I'm used to it. The chap I really came to visit, Bob KL7NC, the publisher of *The Local Paper*, was there, so I was all set.

When Sherry asked if I was interested in going to Alaska I surprised her with a yes. When she asked where in Alaska, I answered Ketchikan. Ketcha-what? Well, it Isn't as well known as Anchorage, Juneau, Valdez, Fairbanks, Sitka and so on, but dagnabit, it's the most visited city in Alaska, and that's where I wanted to go. So we went.

We arrived there on the evening of my 70th birthday. The next morning Bob picked us up and took us to one of the two radio stations for an interview. Then we drove a block to the other station for another. From there it was a two-block drive to the daily paper for a third interview. I talked about my new book, about amateur radio, music, and computers.

If you ever take a cruise to Alaska you'll spend half a day in Ketchikan. At least two cruise ships stop there every day during the summer, so they get over 300,000 visitors a year as a result. It's a town of about 13,000 during the summer and maybe 5,000 during the winter, with the rest heading south for more daylight and less rain.

Rain is the operative word. They average about six clear days a year, so I was very lucky to have two beautiful sunny days for my visit. They get 14 feet of rain a year. That's feet, not inches. I think there's one place on earth where they have slightly more rain. Oddly, they don't get much snow. The main industry is fishing, of course. There are a zillion fishing boats. Tourism is second, so the downtown area is almost wall-to-wall gift shops.

Most of the downtown is built on pilings. There just isn't much flat land around there. Many houses are built on the sides of hills and several "streets" are actually wooden stairs. The town is about two miles long and mostly one block wide, running along the water. It's on an island, so the roads don't go very far. The airport is on a neighboring island, with a small ferry connecting it to the town.

In the afternoon Bob organized a reception at my hotel, giving me a chance to meet more hams and some local politicians. In the evening we went to see a mellerdrammer put on by local non-actors. It had something to do with a fisherman who robbed local fish traps to put his daughter Little Nell through school. Why the villain wanted to marry her (she weighed in at around an eighth ton) I'll never know. She was in love with a Dudley Doright type of chap, who apparently hadn't given any thought to how much it would cost to feed his beloved. Inexplicably, the play has been running summers for 26 years.

The prices are about 50% higher than Seattle, but salaries apparently aren't. A one-day visit about covers things. This gets you to the fish hatchery and the totem pole museum. Hey, that's more than we have for visitors to Peterborough. We've got the McDowell Artist Colony and you're done. The totem poles were more interesting. Ever the entrepreneur, it made me want to get into the totem pole business. Well, I've now visited Alaska . . . and enjoyed it.

My visit to Ketchikan was a wonderful birthday present. Last year we went to Orlando and did Walt Disney World, Universal Studios and Epcot. A couple years before we went on a mystery train round trip between New York and Washington. We were in a club car with the actors while they put on a murder mystery, with the audience as part of the play.

At 70 I get to ski free at the New Hampshire state-run ski areas. And I'm drawing full Social Security benefits now, which is crazy. Other than that the benefits of lasting this long are few. It does tend to bring up the question of how much longer I can last. Both my folks lived to be 87, so I guess my genetic structure is sound. And when you consider that my father smoked until he was around 65, and suffered terribly from emphysema and other smoker's illnesses for the last few years, I might have a chance to beat his record. My mother died of Alzheimer's. If I see even the beginnings of that, I'll consult the book *Final Exit*. There's no way I'm going that route. Of course, if I'm able to put some fire under the medical industry and get them to change their whole basic approach to illness, I could be around for a while. I believe the key to eliminating all illness is within our grasp.

Bob and the people of Ketchikan made our visit a treasured memory. We thank them.

A Packet Newsletter

Paul Straney N2LSS has started a new packet newsletter you might want to check out. Issue #1 shows a good start, with six pages. The subscription price for this bi-monthly is $7 per year. Send Paul a buck for a sample copy (P.O. Box 167, Garrattsville NY 13342).

I'm a huge believer in ham newsletters as aids to the development of special ham interests. Back when *73* was first started we tried to help hamming grow with *6up*, a VHF newsletter, *5-7-9*, a CW-oriented newsletter, and a club bulletin supporting newsletter providing material to help club newsletter editors make their newsletters more interesting. Alas, these all blew away when amateur radio collapsed in 1964 as a result of the ARRL's Incentive Licensing proposals . . . the rule changes they proposed quickly put 85% of the ham dealers and manufacturers out of business within a year or two.

This also killed my growing ham kit business, where we were furnishing kits of parts to help readers build construction projects described in *73*. I bought the parts at Evans Radio In Concord, New Hampshire, and put them into kits for the readers, passing them along at about my cost in order to help them have fun building.

So let's support all of the special interest ham newsletters and help them grow. Help them get advertising and patronize their advertisers. Newsletters, like magazines supporting any new technology, provide needed communications between the hams developing new technologies. They also make it possible for newcomers to the interest to come up to speed fairly easily. And, most important of all, they make it possible for entrepreneurs to go into business providing products for the new technology and reach their potential customers quickly and inexpensively. Without these start-up firms you can't build a new Industry.

When I started publishing *Byte*, back in 1975, this was my aim. I'd gotten the concept from the success I'd had in 1969-72 with supporting NFM and repeaters with my *Repeater Bulletin*, plus hundreds of articles in *73*. When the computer articles I was running in *73* were so enthusiastically received, I knew *Byte* was needed and would be a success.

So keep an eye peeled for ham newsletters and support 'em. Let me know if any interesting newsletters turn up that I may not know about. There are a couple out there being published by hams I consider crooks. I'm not going to waste money with lawsuits by naming them, but you may be sure I won't be recommending 'em. At my age I don't need the extra aggravation.

A Fatter Magazine

Would you like to see *73* twice as thick every month? Well, so would we. I know it's going to come as a humongous surprise to some readers when I let the cat out of the bag . . . the thickness of the magazine is proportional to the pages of advertising. It's that simple.

The time was when *73* had the most ads in the field. That was before IDG trashed it, making many major advertisers terminally angry. So why did I sell it in 1983? Because I had no choice. I was faced with either selling my publishing company, together with all my magazines, or being forced out of business by either IDG or Ziff . . . or both. That's what happens when the megapublishers come into a field.

So I sold everything and started fresh, building a whole new publishing business. That took a couple years. I had to hire and train a new staff, get a new building, put in new typesetting and production systems, and so on. I'd believed that I would continue to be the publisher of *73* for IDG, but I soon found myself locked out. They said the

Continued on page 86

QRX . . .

Number 3 on your Feedback card

Atlas Radio Returns

Herb Johnson W6QKI, whose innovative talents have brought many firsts to ham radio, is back in the marketplace once again. Herb has revived his well-respected Atlas Radio Company and has introduced a new high-quality, yet budget-priced, high frequency transceiver that just about any ham can afford. Priced at only $795, the Atlas 310 features a hot receiver with exceptional dynamic range and a 150-watt output transmitter designed for SSB, CW and digital modes such as packet and AMTOR on all nine bands. For more information, write to: Atlas Radio Co., 1556 Lower Lake, Cardiff CA 92007, or call (619) 944-9622. *TNX Westlink Report #635, October 12, 1992.*

IARU Region 2 Meeting Formally Recognizes HF Packet

The International Amateur Radio Union Region 2 Conference was held in Curacao August 31st to September 4th, 1992, and the decisions made will definitely have an impact on the future of high frequency fully automatic packet radio forwarding worldwide. The group adopted specific terminology to define digital communications as follows.

Digital modes ("digimodes") describe RTTY, AMTOR and packet (including new systems like PACTOR and CLOVER), but not FAX and SSTV; "packet priority" refers to band segments in which digital modes other than packet are permitted, but may not claim protection from packet. It was agreed that CW remains a permitted mode throughout all amateur bands. How to classify digital voice and image modes was left unresolved for the moment, as these were not burning issues and the task at hand was difficult enough.

The joint committee then recommended, and the plenary adopted, band plans for the digital modes as follows.

80 meters: 3.580-3.635 MHz digital modes; 3.620-3.635 MHz packet priority.

30 meters: 10.130-10.150 MHz digital modes; 10.140-10.150 MHz packet priority.

20 meters: 14.070-14.0995 MHz digital modes; 14.095-14.0995 MHz packet priority; 14.1005-14.112 MHz CW/phone/ packet shared (note 1 kHz guard band centered on 14.100 MHz for the NCDXF beacon network). This is a great improvement for packet operation, which under the previous band plan had been limited to below 14.0995 MHz—a limitation that had a lot to do with RM-7248 being shot down. The Region 3 band plan has shown packet to 14.112 MHz since 1988, and the Region 1 band plan has followed suit only since May of this year.

17 meters: 18.100-18.110 MHz digital modes; 18.105-18.110 MHz packet priority.

15 meters: 21.070-21.125 MHz digital modes; 21.090-21.125 MHz packet priority.

12 meters: 24.920-24.930 MHz digital modes: 24.925-24.930 MHz packet priority.

10 meters: 28.070-28.189 MHz digital modes; 28.120-28.189 MHz packet priority.

Because of widely differing patterns of usage, the joint committee was unable to come up with a plan for 40 meters that everyone could agree to. But there was a compromise proposal offered by Ecuador. Under the compromise, 7.040-7.050 MHz would be used for "international packet" while 7.100-7.120 MHz would be available for packet use within Region 2.

There will be some problems implementing this 40 meter approach. Novice activity and the 200-watt power limit that applies to this segment, but we viewed it as a step in the right direction and did not object to adoption of the compromise by the plenary. *TNX Jerry Williamson KC6LHA; Westlink Report #635, October 12, 1992.*

HF Digital Accord Reached in Dallas

Representatives of those amateurs using unattended low-band forwarding under the STA met with the American Radio Relay League's Digital Committee in Dallas to see if an agreement could be worked out, which would result in a proposal to the FCC to allow continued operations after the current STA runs out. The present Special Temporary Authority, issued by the FCC to demonstrate the practicality of such a system, is scheduled to expire December 31st. Since the ARRL's position was to file for "semi-unattended" operation, the packet wizards protested loudly that such a rule change in place of the STA would kill the utility of the network. The following is the ARRL press release issued September 29, 1992:

On September 26 the ARRL Digital Committee met in Dallas with five representatives of the present HF automatic-forwarding STA networks, to discuss ways to continue the existing forwarding networks while protecting the interests of other users of the bands. The participants noted the IARU Region 2 digital band plan which was adopted September 4 in Curacao. This international agreement opened the door to reconsideration of recent recommendations of the Committee to the ARRL Board of Directors.

The committee recommends that the part of the IARU Region 2 band plan providing for digital forwarding be incorporated into the U.S. regulations. The ARRL board will consider this recommendation as a potential petition for rule making to the FCC. The committee also recommended that the ARRL request an extension of the current STA for the period during which new rules are under consideration.

In concert with the recommendation, which would allow automatic operation while providing rules to protect nonautomatic users of the bands, the group formulated a tentative voluntary band plan for the digital parts of the MF and HF bands. Interested parties are encouraged to comment on the tentative band plan, which will be made widely available.

The participants agreed that the changing nature of the digital state of the art requires that periodic review of national and international band plans be made. The committee pledges to work with all segments of the digital community to suggest such changes to the band plans as may be needed in the future.

TNX Westlink Report #635, October 12, 1992; ARRL Bulletin 93.

Cited for Language

The FCC has cited an amateur for "indecent speech" on the 20 meter band. On September 23 the Commission announced a Notice of Apparent Liability (NAL) for $2,000 had been sent to Allen Burton KA4URC of Hornbeak, Tennessee, alleged for willful violation of FCC Rule 97.113(d), which prohibits transmission of indecent words and language on amateur radio stations.

Burton, 60, is a General class licensee. According to the NAL, on the afternoon of June 29, 1992, the Commission's Kingsville, Texas, office monitored a conversation on 14.300 MHz which included KA4URC. "We find," the NAL said, "that the words and language transmitted are indecent within the meaning of Section 97.113(d) and prevailing Supreme Court and Commission precedent."

"We find that the transmissions describe sexual acts and organs in a patently offensive manner and go well beyond what an average adult person in any community would consider to be worthy of protection," the Commission said.

The NAL said one of the Commission's goals is to "protect children from exposure to sexually explicit communications over the airwaves," and noted here that "the transmissions were made in the summertime in the afternoon when there is a real likelihood that children are listening." An ARRL survey of young radio amateurs was used as corroboration.

Burton was fined less than the $5,000 that Commission guidelines would have allowed because it was his first offense and because he is an individual rather than a corporation (such as a broadcast radio or television station). Burton has 30 days in which to pay the fine or to explain why it should be reduced or not imposed. *TNX The M.A.R.C. News, October 1992.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine,* Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun.* You can also send news items by FAX at (603) 924-9327.

Number 4 on your Feedback card

The Techno-Whizzy 1, Part I

Build a direct digital synthesis (DDS) radio.

by John Welch N9JZW

I've grown tired of the same old designs being rehashed over and over again. I wanted something new, something state-of-the-art, but my wallet balked at paying over $2,000 for a new rig. Nobody offered a cheap Direct Digital Synthesized (DDS) radio but, folks, it is not only possible to design one, it is both fun and easy.

No, it doesn't have *all* the bells and whistles yet. What it does offer is a chance to build a DDS radio of your own, for a lot less than buying a whole new rig. It's modular, so as I (or you) design new boards they can be added to the basic unit without throwing out all your work. I call it the TW-1, for Techno-Whizzy, model 1.

The TW-1 is a modular multiband CW QRP transmitter, using a new Direct Digital Synthesis (DDS) chip from Qualcomm (1055 Sorrento Valley Rd., San Diego CA 92121; Tel: (619) 597-5005). It has 11 diode-programmable channels and one dip switch variable frequency channel, and it puts out 2 watts from 1 MHz through 21.5 MHz (that's 160 meters, 80 meters, 40 meters, 30 meters, 20 meters, 17 meters and 15 meters, FULL COVERAGE, plus many MARS and CAP bands to boot). With some modifications to the amplifier stage it can even cover the 1750 meter Experimenters Band. I'm planning to eventually add a receiver board, a linear amp, a doubler to get full HF coverage, a digital signal processor to handle SSB and a digital frequency display with keypad input.

Instead of a VFO, the heart of this transmitter is the new Q2220 DDS chip from Qualcomm. It runs at 55 MHz clock input, and has a 24-bit phase accumulator. In English, this means that the minimum frequency change is 55,000,000 / 2^{24} (two raised to the 24th power), or just about 3 hertz. Above 1/8th the clock frequency, the quality of the output signal falls off, but tight filtering can remove the harmonics. Between 1/3 and 1/2 the clock frequency is the maximum output frequency you'll get without a *lot* of fancy filters. I've designed the TW-1 to run at any frequency from 3 hertz to over 21 MHz in 3 Hz steps while maintaining a decent sine wave output to the amplifier. With the additional filtering after the amplifier, it's FCC legal—the spurious emissions are all more than 30 dB down as measured on a spectrum analyzer.

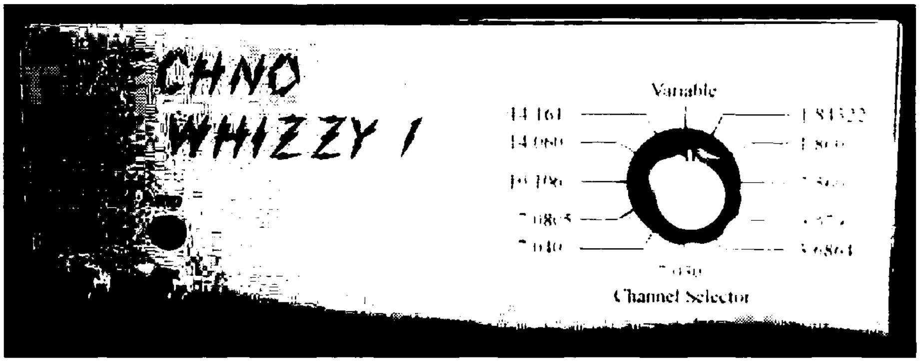


Photo A. The Techno-Whizzy 1 DDS transmitter.

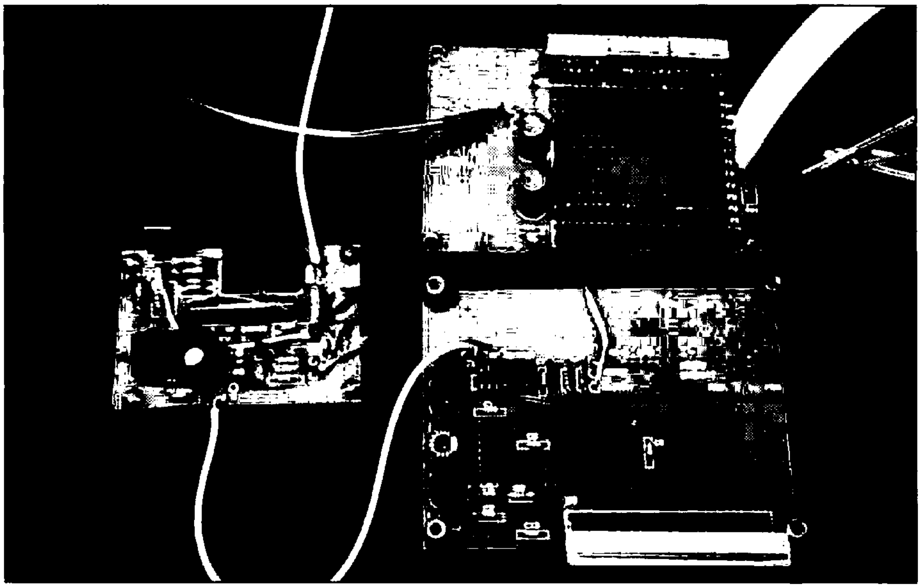


Photo B. The TW-1 DDS transmitter consists of three separate PC boards. The RF amplifier is shown on the left, the diode matrix for frequency selection is shown at the upper right and the DDS synthesizer board at the lower right.

How It Works

The frequency is set using pull-up resistors and diodes. The input to the Q2220 chip is binary (don't panic—I'll explain this later), with 1's being a 5-volt input and 0's being grounded inputs. There is a line of pull-up resistors, one for each input line, and a place to install pull-down diodes. When you select a channel, it grounds the cathode end of that row of diodes, pulling those lines low.

The Q2220 reads the input lines from the frequency selection board 55 million times a second (once per clock cycle), and adds that value to its current value in the phase accumulator. (If the result is larger than 2^{24}, it subtracts 2^{24} from it to keep the phase angle between 0 and 2^{24}). This number, expressed as a percent of 2^{24}, tells the DDS how far around a circle it currently is. It then calculates the sine at that position, and outputs the sine's value to the Digital-to-Analog Converter (DAC).

The DAC then takes this value and translates it into a voltage between DC and 1 volt. At this point, the signal doesn't look like a sine wave—it looks like a staircase with up to 256 steps built on a sine wave. To remove the "staircase," the signal is passed through a seven-pole low-pass filter that cleans it up. The now-clean sine wave (at 2 milliwatts) is sent to a low-level class A linear RF amplifier.

If the key is on, power is applied to the class A driver amplifier, which then amplifies the signal to 80 milliwatts and passes it to the final amp. The final runs class A also, for maximum linearity (after all, if you've gone through all the trouble of making a clean sine wave, why mess it up with a nonlinear amp?). The final outputs 2 watts into a 50-ohm load (either a dummy load or your antenna).

Switching to another frequency is easy; just turn the channel knob. The DDS chip reads the new value, and starts all over from

there. It takes six clock cycles for this change to be seen at the driver stage, which is about 120 ns—so fast it's effectively instantaneous. There are no adjustments to tweak, no guessing where you are—just *click* and you're there. That's the joy of a digital rig!

How to Set the Frequency

Okay, now for the hard part—math! With the simple setup this rig has, you do have to do some pencil work. It's not hard, and you can even cheat two ways—I've included a table of several standard QRP frequencies and there's BASIC source code for a program to compute the frequency if you have a computer.

Keep in mind that there is a difference between repeatability and absolute accuracy. This rig is repeatable—a channel is always on the same frequency it was last time. It can also be accurate, but you'll have to measure the output frequency of your particular oscillator. Mine was 55.001 MHz or so at room temperature. If you want accuracy, use your exact oscillator frequency instead of 55 million in the following calculations. Note: The table was designed using 55 million—it'll be close to the correct frequency and repeatable, but not absolutely accurate.

Remember earlier where I said the DDS has a 24-bit phase accumulator, and runs at 55 MHz? The size of a step, then, is 55 million divided by 2^{24}. To get the radio on your desired frequency, divide your frequency by that step (55000000/16777216, or 3.2782555). Convert this number to binary—use a scientific calculator, computer or a 13-year-old computer nut for this. The number must have 23 digits—if you're short a few, put 0's at the *LEFT* side until you have 23 digits.

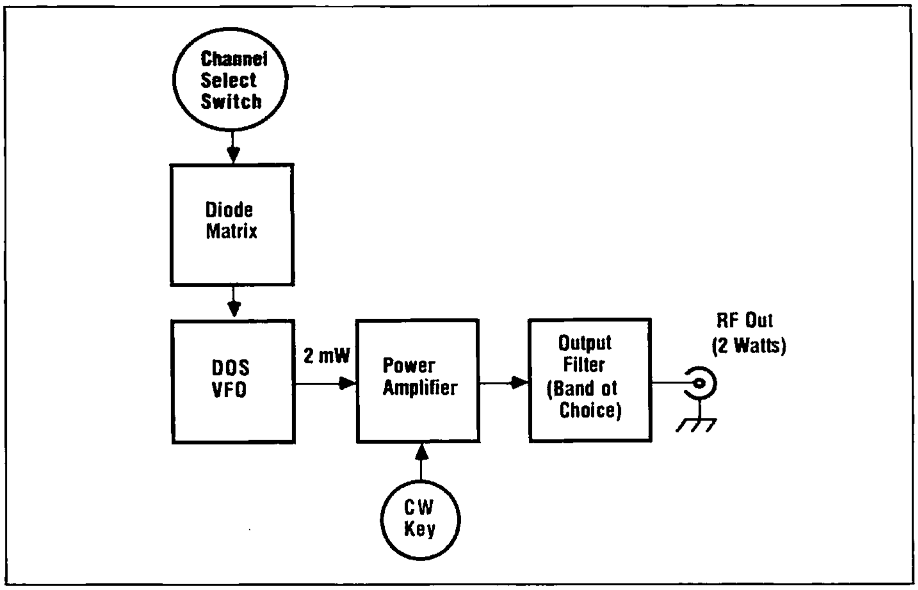


Figure 1. Block diagram of the TW-1 DDS transmitter circuit.

Pick an unused switch position and find the line of holes for that channel (they're numbered starting from F1 at the ribbon cable back to F11 near the resistor packs). Counting from left (nearest the power supply) to right, at every place you had a 0 put in a diode (1N914s will work fine) with the cathode (the banded end) in the air and the anode through the hole. Leave any spot that had a 1 empty. Run a wire tying all the cathodes together, and run that wire into the hole nearest the silk-screened "F??" label for that channel. When you switch the channel selector to that channel, the diodes conduct, pulling those lines to ground. The lines without diodes remain at 5 volts.

For example: If you want to set the TW-1 to 7,040 kHz on channel 1, take 7040000/3.278555 = 2147483. Converting this to binary gives you 010 0000 1100 0100 1001 0110. You would put a diode in holes 1,3,4,5,6,7,10,11,12,14,15,17,18,20 and 23. (See Figure 6 for details). If you wanted this frequency on the DIP switch channel (chan-

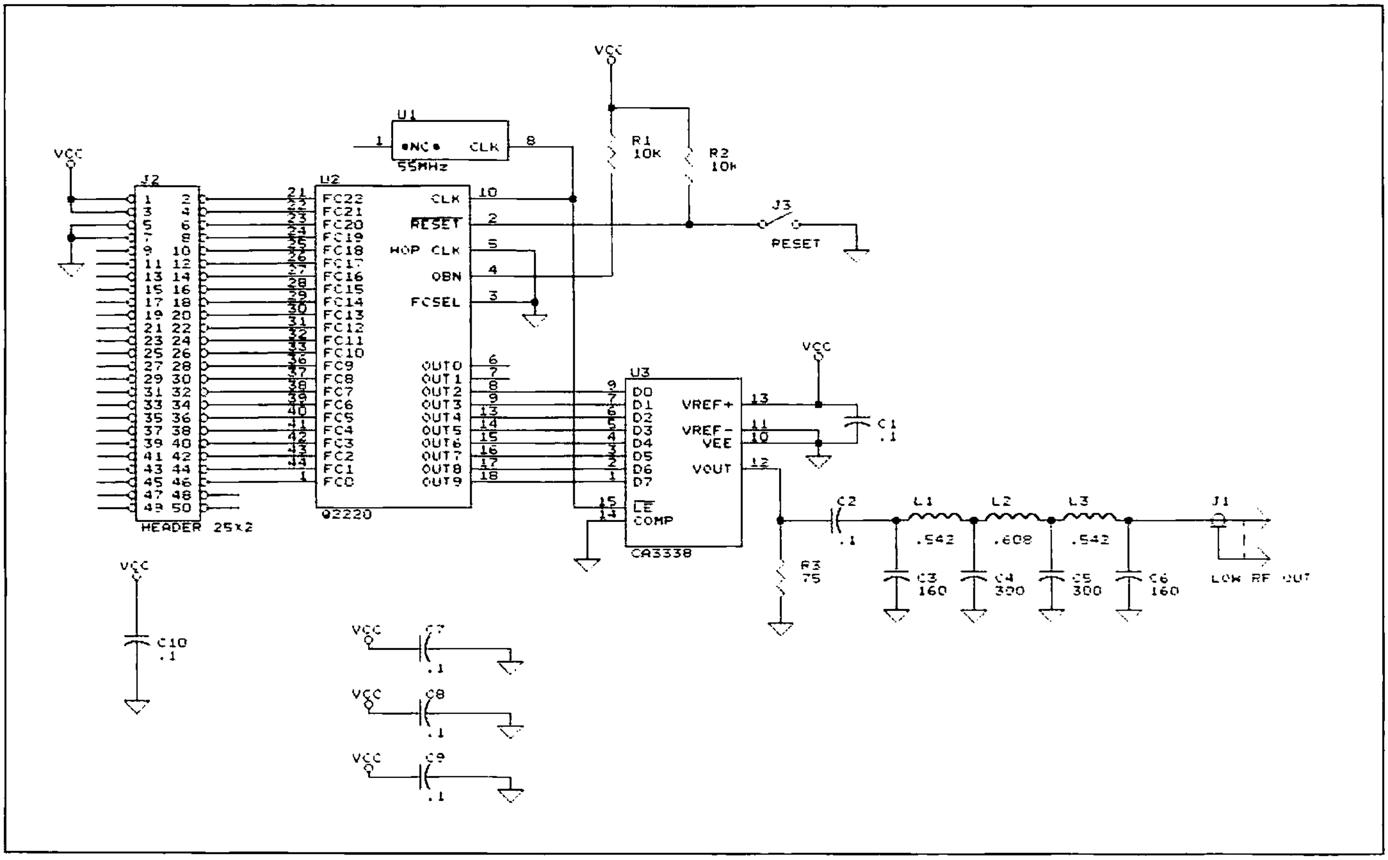


Figure 2. Schematic diagram of the DDS VFO board.

nel 12), for any digit that was a 0 turn the switch ON. This will pull those lines to ground when you select channel 12.

Doing 7030 kHz gives 2144433, or 010 0000 0110 1000 0110 0001 in binary. 10.106 MHz gives 010 1111 0000 1001 1111 0001 in binary. For other values, see the chart on p. 18 showing some common QRP frequencies. If you don't like the math and need a different frequency, I've written a program you can use (see the program listing on p. 18).

Construction

Take a tip from me—use a fine-tipped low-wattage soldering iron for these boards. The pins sometimes have traces running between them, so keep a keen eye out for solder bridges and cold solder joints. When you're done soldering, nip off the leads close to the boards. This keeps things looking neat and will prevent accidental shorts when you assemble the boards into a chassis.

Build the power supply and frequency selector board first. Install the DIP switches and their diodes first, with the banded ends of the diodes tied together to the hole near the DIP switches. Set the DIP switch (channel 12) to 7,040 kHz (see above). Attach the 12-position channel switch to a short length of ribbon cable, with the common connection on the red wire. Run this cable to the 13 holes at the right side of the board, with the red wire at the top. Bend one set of pins on the resistor packs horizontal (or use individual resistors—I did), and put the resistor packs on the board with the horizontal set of leads in the holes and the other set in the air. Run a bare wire from the JUMPER hole across the pins in the air, soldering to each pin. Install the 50-pin header, being careful of shorts. Make sure you have the 7805 and the electrolytic caps in correctly. Check all connections for shorts and bad solder joints. When you're satisfied with your work, apply 12 volts to the power supply. You should have 5 volts at the jumper; if not, check your wiring.

At the holes marked FF (for Frequency, Future), you should read 5 volts on holes 2,8,9,13,16,19,21 and 22. Holes 1,3,4,5,6, 7,10,11,12,14,15,17,18,20 and 23 should be at ground (0.7 volts or less). Remove power from the board and it's functional!

Next, build the DDS board. Install U1, the clock oscillator, first. The mounting is designed to allow either a 14-pin-sized oscillator or an 8-pin-sized oscillator. Pin 1 is the same for either, but the 8-pin-sized oscillator is shorter and only reaches to the first set of holes. A 14-pin-sized device covers the middle set of holes, and installs in the second set of holes. If you want to socket this chip, use a 14-pin socket but remove the unused pins. Also, install the jumper wire from U1 to U2 now.

Install the socket for the DDS chip (U2) next. Make sure the socket matches the outline, with pin 1 facing up and the angled corner in the upper left. Install U3, the DAC, and the 50-pin header. These parts all have wires between pins, so be very careful when soldering them.

I socketed U3, and ran into phase jitter problems that were cured by adding two extra bypass caps soldered directly to the pins on U3. I added a 1.0 µF cap between pins 16 and 14, and another between pins 13 and 11. For best results, these should be tacked in either on the chip or under the board, but keep the leads as short as possible for good bypassing.

Install the filter next. L1 and L3 are 12 turns on a T37-2 (red) core and L2 is 14 turns on a T37-6 (yellow) core. For those who are new to this, a "turn" is any time the wire goes through the hole. (A bobby-pin on a core would be one turn.) Once you have these wound, spread the turns out to cover

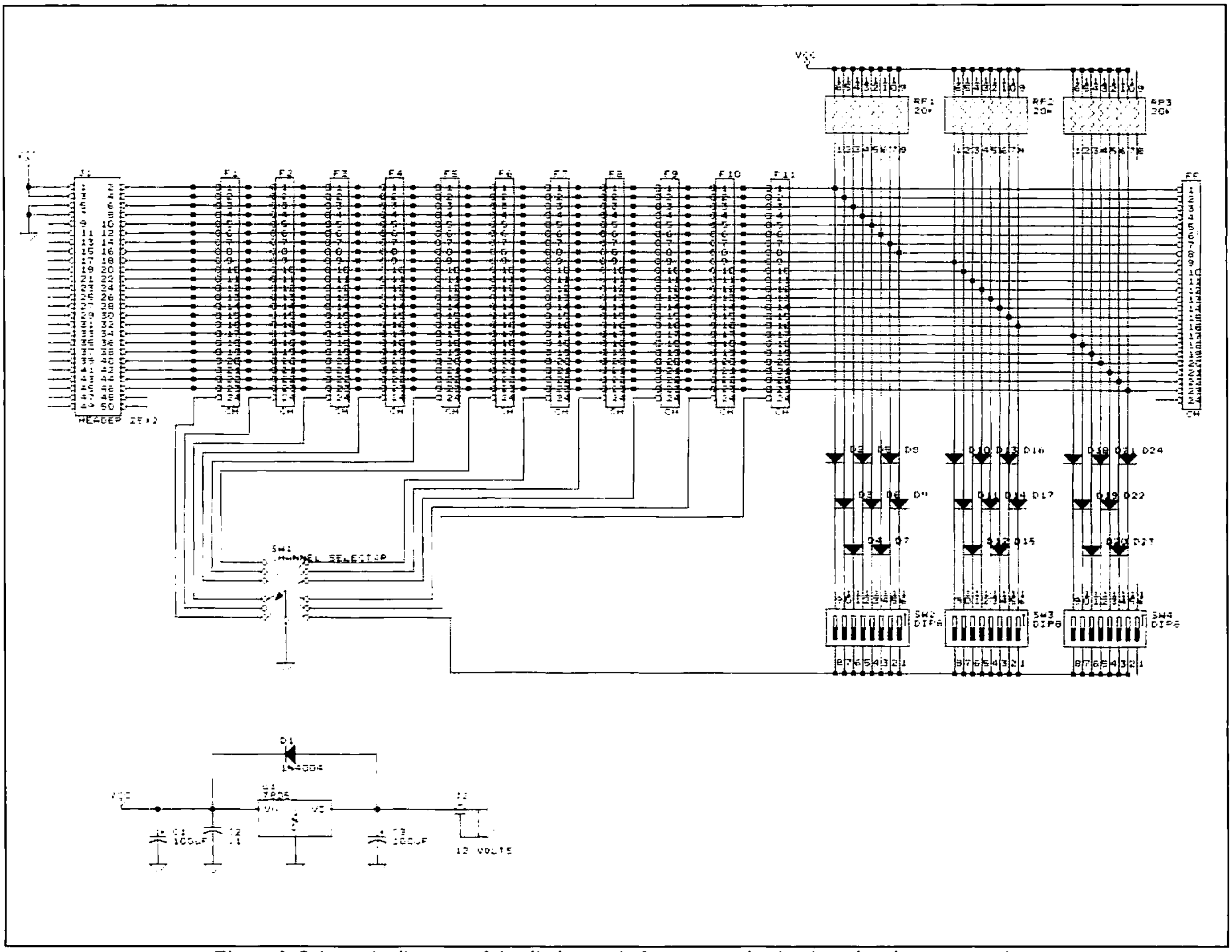


Figure 3. Schematic diagram of the diode matrix frequency selection board and power supply.

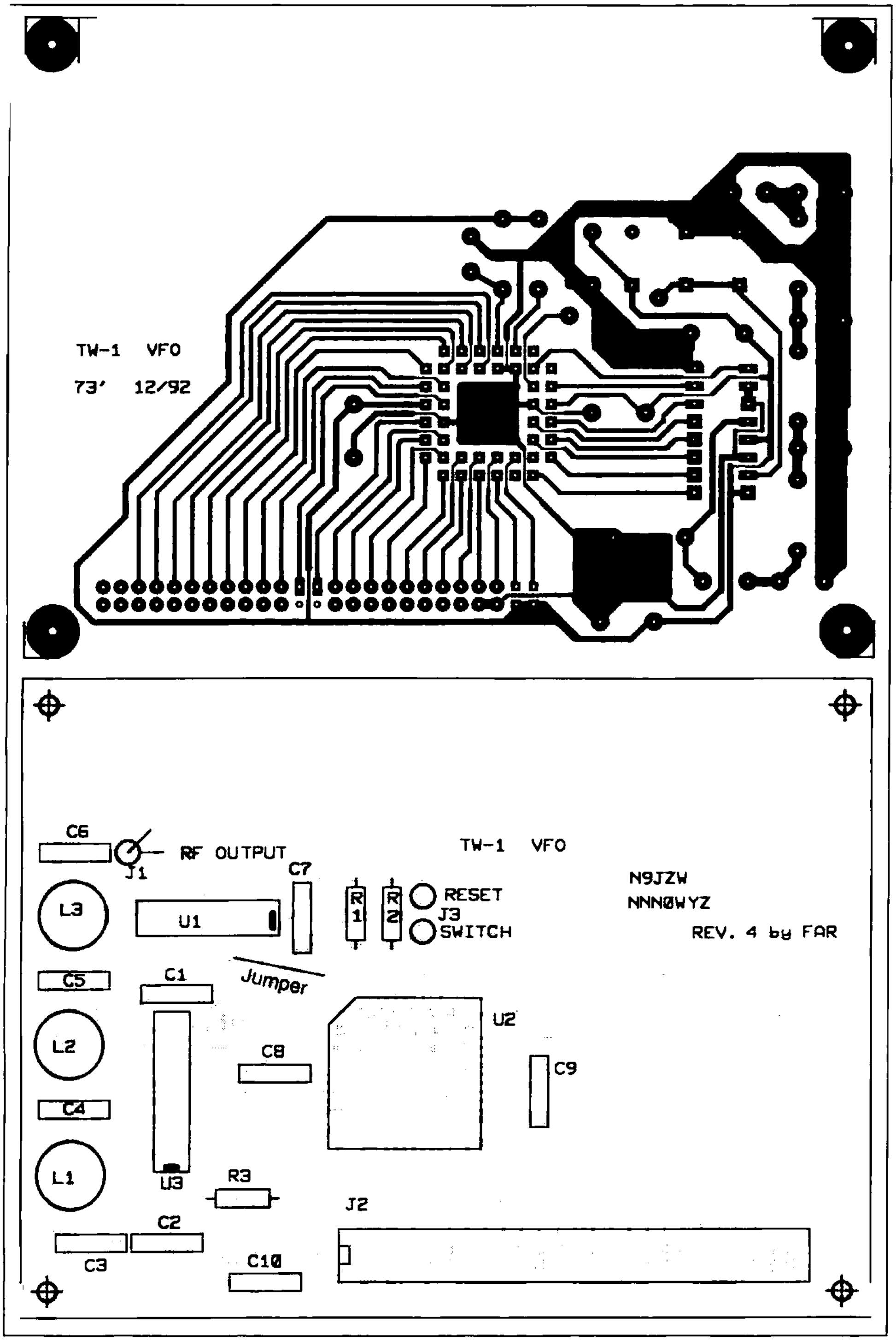


Figure 4. (a). PC board foil pattern for the DDS VFO board. (b). Parts placement.

three-quarters of the core, then cover the cores in plastic model cement. Make sure you remember which core is which!

Install the remaining resistors and capacitors in their proper places. Solder a short (5" or so) length of RG174 coax cable to J1, with the center connected to the trace going to L3 and the braid connected to ground (the other hole). Solder another short hunk of two-conductor wire to J3, and put an SPST Normally Open momentary switch at the other end. This is the RESET switch, which resets the DDS chip. You'll probably never use this, so it can go on the back of the case.

Attach the DDS board under the power supply board, leaving a small gap. Mounting holes have been provided at each corner for this. Make the ribbon cable to connect the first board with the DDS board. Pin 1 is on the left side, and should be the red stripe on the cable.

Check all work carefully, because we're going to give it a trial run now. With the DIP switches set to 7,040 kHz as above, connect the two boards with the ribbon cable. Set the channel switch to 12. Connect power to the power supply board. You should get 5 volts at pin 1 of U1. The input lines on the 50-pin header should be the same as they were when you tested the power supply board. Remove power—we're ready for a live test!

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposide this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to 73.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can alos enter your QSL in our QSL of the Month contest. All for the low, low price of 29 cents!

The Techno-Whizzy 1, Part I

Continued from page 15

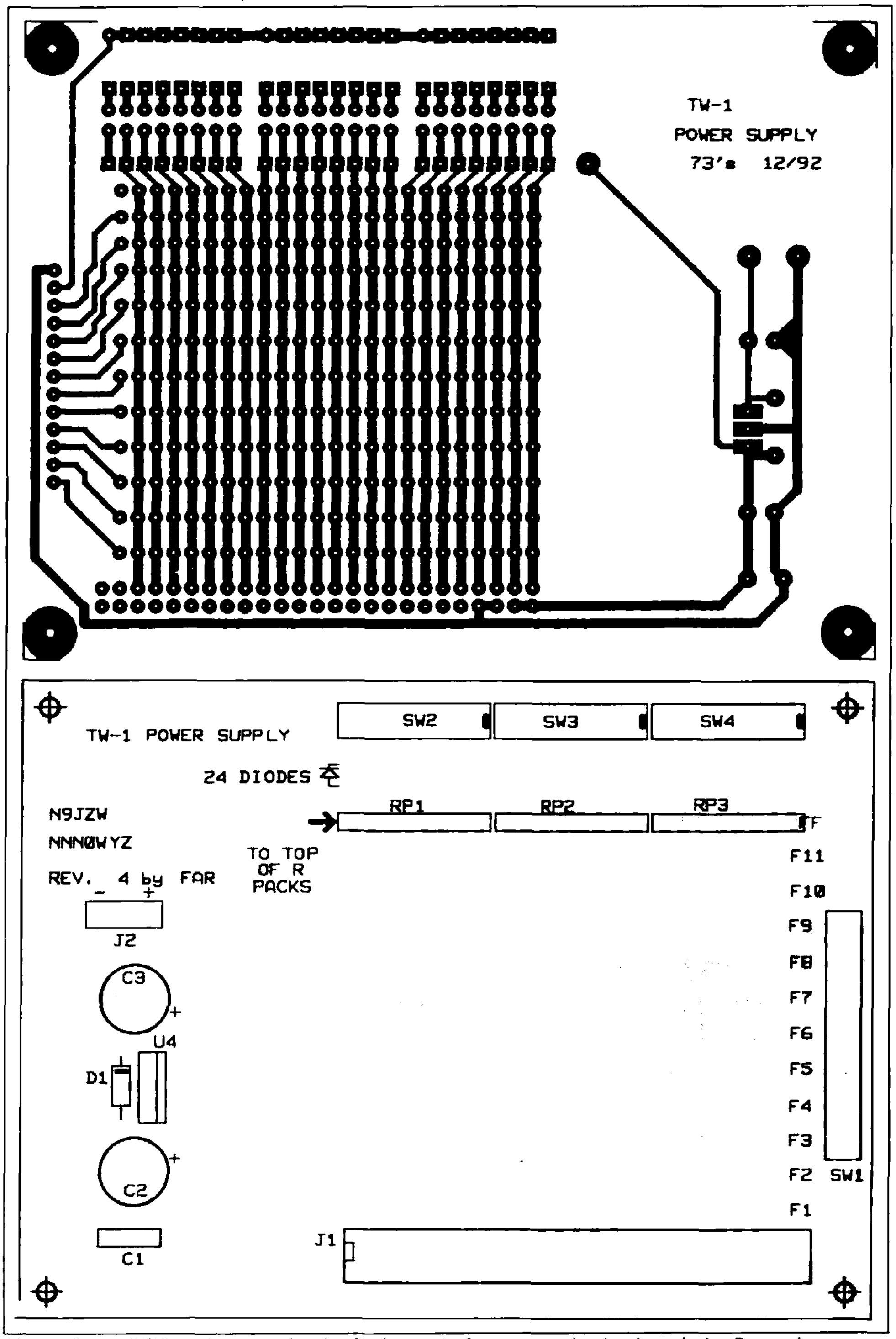


Figure 5. (a). PC board pattern for the diode matrix frequency selection board. (b). Parts placement.

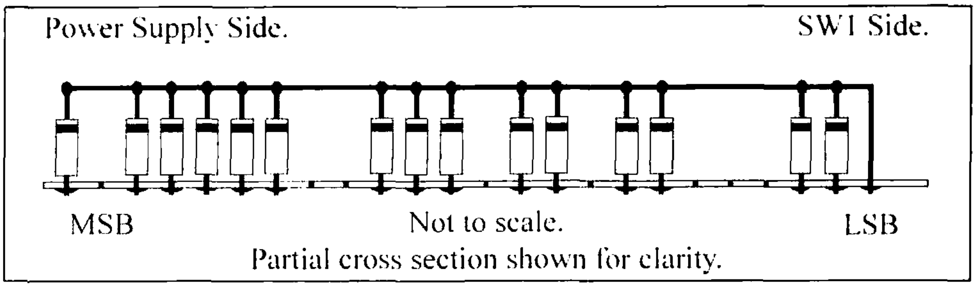


Figure 6. An example of diode array programming for frequency selection. A frequency of 7.040 MHz is shown. The view is from the front side of the frequency select/power supply board.

Continued on page 18

Install the chips in the sockets. Be especially careful installing U2! Removing this chip requires a special tool to prevent damage, so make sure it faces up! You should be able to read the chip number if you have the 50-pin header at your lower right.

Temporarily solder a 51-ohm resistor across the free end of the RG174. Hook a frequency counter to the hot end of the 51-ohm output resistor. Once again, apply power. You should have 7,040 kHz coming out of the unit. If so, congratulations! You've just built a basic DDS VFO!

If it didn't work, check for power on pin 1 of the ribbon cable. If there's power, check for +5 on pins 4 and 16—2,6,8,10,12,14 should be ground. If these aren't right, check the ribbon cable and connectors.

If there's power to the VFO board, look at the inputs to the DAC (U3 pins 2-9). These pins should be changing very fast. If they aren't, re-check the soldering on U2, check for clock signals out of U1 and try pressing the RESET switch. If the signals work while you press RESET, you've got a Normally Closed switch.

If the inputs to the DAC are changing, look for output. If there's no output, the chip may be in backwards or dead. If there's a signal at the output of U3, all that's left is the filter and the cable. Check these, and repair as necessary.

Now that you have a functional VFO, hook up a scope to the output. You should have a 0.7-0.8-volt peak-to-peak sine wave that looks pretty clean. Unplug the power, remove the 51-ohm resistor from the RG174 coax and you now have a very useful signal source and test generator.

Next month in Part II, we will turn this low-level (2 milliwatt) signal into something a little more useful by adding a 2-watt amplifier which should make this into a very capable QRP rig.

Some Common QRP Frequencies for the TW-1

Frequency (MHz)	Set TW-1 diode array to: MSB					LSB
1.810	000	1000	0101	1100	1011	1011
1.84322	000	1000	1001	0100	0101	0000
1.860	000	1000	1010	1000	0100	1111
1.900	000	1000	1101	0111	1111	1001
3.54025	001	0000	0111	1010	0101	1111
3.560	001	0000	1001	0001	1111	0111
3.579	001	0000	1010	1000	1001	1011
3.6864	001	0001	0010	1000	1001	0100
7.030	010	0000	1011	1000	1011	0001
7.040	010	0000	1100	0100	1001	1100
7.0805	010	0000	1111	0100	1101	1110
7.110	010	0001	0001	1000	0000	0100
10.106	010	1111	0000	1001	1111	0001
14.060	100	0001	0111	0001	0101	0010
14.161	100	0001	1110	1001	1011	1100
18.074	101	0100	0010	0000	0101	0010
21.060	101	0010	0000	0101	0101	0100

Put diodes, banded end up, wherever there is a 0 (zero).

Parts List

DDS VFO Board

C1,C2,C7,C8, C9,C10	0.1 µF ceramic	
C3,C6	160 pF silver mica	
C4,C5	300 pF silver mica	
J1	Low RF out	
J2	50 pin-header (25 pins by 2)	Digi-Key# 923876-R-ND
J3	Reset switch, SPST (Normally ON) momentary	
L1,L3	0.542 µH, 12 turns #26 enameled wire on T37-2 toroid	
L2	0.608 µH, 14 turns #26 enameled wire on T37-6 toroid	
R1,R2	10k ohm, 1/4 watt	
R3	75 ohm, 1/4 watt	
U1	55 MHz oscillator module	Digi-Key# SE1109
U2	Q2220 DDS by Qualcomm (See note below)	
U3	CA3338AE DAC by Harris	Digi-Key# CA3338AE
1	44-pin PLCC socket for U2	Digi-Key# A417-ND
1	If needed	1 µF ceramic between pins 16 & 14 of U3
1	If needed	1 µF ceramic between pins 11 & 13 of U3
1	Ribbon cable connector	Digi-Key# ASC50T-ND

Diode Matrix Frequency Selection & Power Supply

C1,C3	100 µF 25-volt electrolytic	
C2	0.1 µF	
D1	1N4004	
D2,D3,D4,D5,D6, D7,D8,D9, D10,D11,D12, D13,D14,D15, D15,D16,D17, D18,D19,D20, D21,D22,D23,D24	1N914	
J1	50-pin header (25 pins by 2)	Digi-Key# 923876-R-ND
J2	12 volts in	
RP1,RP2,RP3	20k ohm, 1/4-watt R-packs or 20k, 1/4 watt individual resistors	Digi-Key# 761-3-R20K
SW1	Channel selector 1P12T rotary switch	Digi-Key# EG1952-ND or GH5601-ND
SW2,SW3,SW4	8-position DIP switches	Digi-Key# A5208-ND
1	50-pin ribbon cable connector	Digi-Key# ASC50T-ND
U1	7805 voltage regulator	
Misc.	—	1N914 for setting channels

A complete kit of parts (including the PC boards) is available from Elktronics-NE, Rt. 1 Box 789, Hancock NH 03449, Tel: (603) 525-4001. Prices as follows: *DDS VFO module* — $99; *Diode Matrix module* — $49; *Power Amplifier module* — $49; *Output Filter module* (specify band)— $10. *A complete package of all modules* — $199. The Qualcomm Q2220 DDS chip can be ordered separately for $39. All prices include postage/handling.

Etched and drilled PC boards for this project are also available separately from FAR Circuits, 18N640 Field Court, Dundee IL 60118. Pricing: *DDS VFO PC board* — $8; *Diode Matrix* — $8; *Power Amplifier* — $6; *Output Filter board* — $3. Please add $1.50 per order for shipping.

The Q2220 (as well as data sheets) is also available directly from Qualcomm, 10555 Sorrento Valley Rd., San Diego CA 92121; (619) 597-5005, for $49, but they have a $150 minimum order.

The CA3338A, the 55 MHz clock oscillator and most of the small parts are available from Digi-Key; (800) 344-4539.

Toroids are available from Amidon Associates or KA7QJY Components (Danny Stevig), Box 3893, Logan UT 84323; Tel: (801) 563-5173.

Basic Program to Determine Diode Array Placement for a Given Frequency.

```
10 REM tw1-freq.bas  by n9jzw  nnn0wyz  9-24-92
20 REM program computes the layout of the binary array of diodes for
30 REM setting the tw-1 to a given frequency
40 REM load the hex-to-binary conversion table
50 DIM binary$(16)
60 FOR x = 1 TO 16
70 READ binary$(x)
80 NEXT x
100 REM set the clock speed and number of bits of phase accumulator
110 clock = 55000000
120 phase = 24
130 REM set the maximum step rate
140 fstep = 2 ' phase
150 REM compute max frequency  (MHz) that still has 3 steps per cycle
160 max = (.4 * clock) / 1000000
170 PRINT "Maximum frequency is"; max; "and minumum frequency is .0001"
180 INPUT "Enter the frequency in MHz (eg 7.040 = 7040KHz) -->"; freq
190 IF freq < .0001 GOTO 170
200 IF freq > max GOTO 170
210 REM compute the frequency setting in decimal
220 setting = (freq * 1000000) / (clock / fstep)
230 REM now in binary...
240 diode$ = "0000000000000000000000"
250 temp$ = HEX$(setting)
260 FOR x = 1 TO LEN(temp$)
270 temp1$ = MID$(temp$, x, 1)
280 IF temp1$ < "A" THEN 300
290 temp1$ = STR$(10 + ASC(temp1$) - ASC("A"))
300 temp = VAL(temp1$)
310 diode$ = diode$ + binary$(temp + 1)
320 NEXT x
330 PRINT "Put diodes, banded end UP, in the positions which have 0s:"
340 PRINT RIGHT$(diode$, phase - 1)
9000 DATA "0000","0001","0010","0011","0100","0101","0101","0111"
9010 DATA "1000","1001","1010","1011","1100","1101","1110","1111"
9999 END
```

Number 5 on your Feedback card

The Key to Unlocking the HTX-100

by Edward Oros AC3L

One of my favorite radios is Radio Shack's HTX-100. I've had a lot of fun working DX from my car with this rig. It is also one of the easiest to modify, if you want to unlock the RIT.

One of the major drawbacks with a rig of this class (HR-2510, HR-2600, HTX-100) is the tuning. There are usually four-step sizes used when tuning to the desired frequency (500 kHz, 10 kHz, 1 kHz and 100 cycles). The 500 kHz step is rarely used; its main purpose is to move you from one part of 10 meters to another. For example, if you are in the CW portion of the band and want to move to the SSB end, this switch is handy. The 10 kHz step tuning can be used when looking for contacts, but you skip over most of the band. The 1 kHz step isn't too bad, but if the other station is 1/2 kHz off frequency you'll have to switch over to the 100-cycle tuning. Even then, the station may be 50 cycles off from you. I always find myself using the 10 kHz step to find a section of the band with activity, then switching to the 1 kHz step to pick out a "loud one," then switching again to the 100-cycle tuning to fine-tune the person in. Many times I still can't get the station in just right, and there just isn't any other way to get any closer to their frequency! Sure, you can use the rig's RIT control to tune your receiver right on, but then your transmit frequency is still off a bit since it doesn't move with the RIT control!

The Conversion

What's the answer? A simple modification to allow the transmit frequency to move in sync with the receiver frequency when using the RIT control. This mod takes only a few minutes, is reversible (in case you change your mind later) and really makes the radio a pleasure to use afterwards.

There are only two parts to this conversion. You'll need a 6-inch piece of wire and a 10k variable resistor. Any 10k pot should work fine.

To begin the conversion, first place the radio on a flat SOFT surface (the cases of these rigs seem to scratch easily) with the speaker side down, and place the rig so the front is facing you. Remove the top four cover screws and the top cover. Locate the radio's lamp light, and follow the white leads down to the green circuit board. Notice that one of the lamp's leads is connected to a point on the board marked +8. Now look on the circuit board to the right of the +8 point. You should see a white jumper plug. In front of this and slightly to the left is a printed circuit board trace line. It is a straight line with a solder point on each end. If you have a voltmeter take a voltage reading from this trace against the chassis ground. It should read near 7 volts. Mark down this number.

Next, disconnect the power from the radio. Take the 10k variable resistor and solder the center tap lead of the resistor to the board at the +8 solder point. Next take the 6-inch wire and solder it to either of the two remaining leads of the variable resistor. Use a sharp tool to break the straight line trace that you just found. Cut it in the middle of the line if possible. Then solder the free end of the 6-inch wire to the end of the trace closest to the front of the radio. The existing end solder point works nicely for this. This trace line originally provided voltage only during receive. Since the 8-volt source that we are now tapped into is there during both receive and transmit, the control will now change frequency in both cases.

Connect the antenna and power but do not replace the cover yet. Now you have to reset the radio back on frequency. To do this, you can use a frequency counter, or a local ham. Set the RIT (now RIT/XIT) to the center OFF position and adjust the 10k resistor to set the radio on the correct frequency. Have your ham friend transmit on a pre-determined frequency while you set the resistor to tune them in. Another method would be to use the voltage reading that you took earlier—you can just check the center tap of the resistor now and set the pot to the original voltage and you will be close to the correct frequency. Once back on frequency replace the cover, screws, antenna and power. At this point, let me inject a word of warning, your frequency display WILL NOT CHANGE as you use this new RIT/XIT. So be careful around the band edges, don't get too close or you may actually be out of band!

Now you're ready to see how much easier the rig is to operate. With the RIT unlocked, I generally leave the step size set to the 1 kHz position, tune close to a "loud one" and then just use the RIT/XIT for the final touch up. You get about 1-1/2 kHz on each side of the control's center. It's great! Have fun and I'll see you on 10 meters!

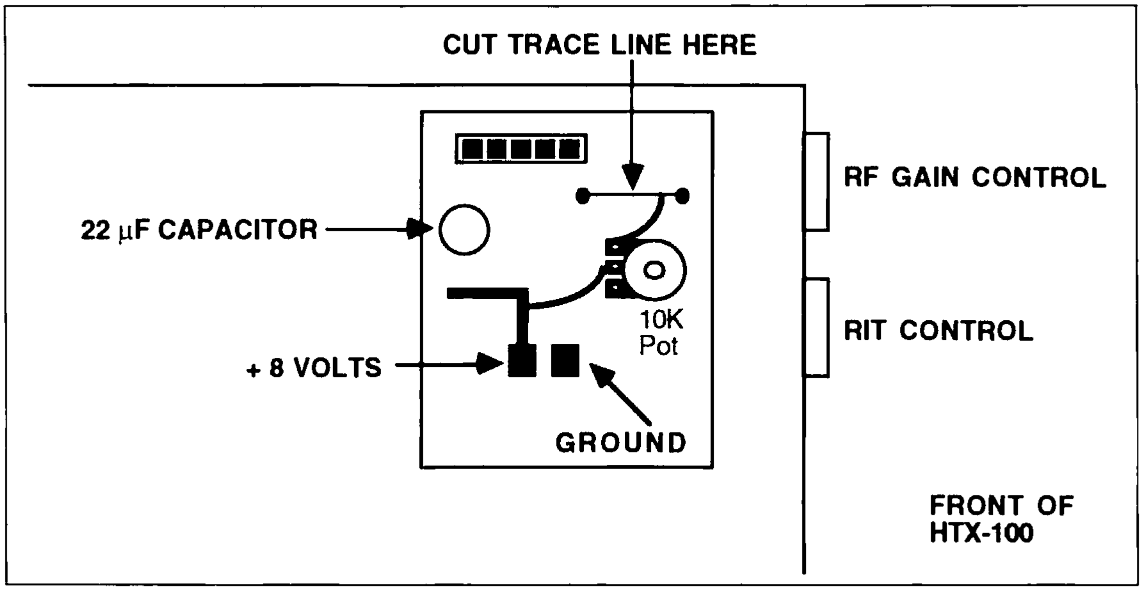


Figure. Cut the trace and wire in a 10k pot as shown to allow your transmit frequency to track along with the RIT control.

73 Review

by Bill Clarke WA4BLC

The ICOM IC-728 HF Transceiver

ICOM America
2380 116th Avenue N.E.
Bellevue WA 98004
(206) 454-8155
Price Class: $1,099

Top-of-the-line performance in an inexpensive package.

When I first had the chance to operate a new IC-728, I looked at it as an inexpensive and plain radio without many of the bells and whistles found on top-of-the-line transceivers. However, after a few days of use I was so impressed by its ease of operation and the high quality of the receiver that I felt that this affordable transceiver could definitely hold its own when compared with top-of-the-line radios.

Features

The IC-728 has all the features I feel are necessary to effectively operate on today's busy bands: pass-band tuning; a very effective noise blanker; a switchable receiver preamp; a 20 dB receive attenuator; variable AGC; RIT; 10 Hz readout; an RF power level control; a speech compressor; and a microprocessor that is smart enough to handle memory, frequency, mode, and other operations properly.

There is no digital keypad, built-in keyer, individual controls for noise blanker width, audio tone, or odd configurations of RIT on the IC-728. However, what few controls it does have are logically laid out on the front panel.

Fortunately, ICOM wasted no money on a manual notch filter for the IC-728. After all, everyone knows that I say, "Get an automatic notch filter—it'll be the best money you ever spent for an accessory!"

Operations

The manual, although small in size, contains the necessary information required for proper operation and use of all features of the IC-728. Additionally, instructions are given for many maintenance operations and adjustments. An excellent owner/operator troubleshooting chart is part of the manual. One flaw of the manual is the sometimes lack of in-depth explanations for control settings.

The tuning knob has a good feel and serves the dual purpose of frequency change and band change. The rate of tuning can be speeded up by pushing a switch and the dial weight can be changed by adjusting a tension screw on the front panel. A 10 Hz readout is selectable.

The ICOM IC-728.

The VFO operation is typical of most current solid-state rigs. A and B can be selected, A can be equal to B, and split operations are possible. Memory and VFO information are interchangeable. When you QSY from one band to another, the mode and frequency last used will be stored/recalled for the band left/chosen.

Modes (SSB/CW/AM/FM) are selected by push-button; however, it should be noted that to operate AM transmit and any FM, the IC-728 requires installation of an optional UI-7.

The PBT (pass-band tuning) works as expected; this feature is required on today's crowded bands.

There are 26 memory channels selectable by UP and DOWN front panel switches and various SCAN configurations can be set up. Mode selections are included in the memories.

The standard (included) microphone has UP and DOWN switches for lazy-man tuning. The condenser element and circuit are typical.

Semi-break-in CW with adjustable hold is standard; CW filter(s) are not. Optional plug-in filters of 250 or 500 Hz bandwidths are available.

The RF output power level is fully adjustable from 10 watts to 100 watts (CW and SSB). The meter displays RF relative output and received signal strength (S-meter).

LEDs indicate XMIT and RX (when the squelch is opened). The squelch can be used in all modes. The XMIT LED doubles as an ALC indicator by changing brightness.

The rear panel of the IC-728 has a number of accessory sockets that are not generally found on other comparable XCVRs. Outputs/inputs include: switched 13.8 VDC, audio (fixed level), squelch, tuner information, AFSK, ALC, amplifier switching, etc.

Computerized operation is afforded through an optional CT-17 CI-V Level Converter with speeds to 9600 baud.

How It Performs

The IC-728's receiver is triple conversion and uses direct digital synthesis. It is both sensitive and quiet—very quiet! ICOM has really perfected DDS (direct digital synthesis).

I was not prepared for the quality of the

receiver the IC-728 provides. In performance it is comparable to my trusted Ten-Tec Corsair II and outperforms my IC-751A hands-down. I don't make this statement lightly, as both have been standards to which all others have been compared.

Selectivity and sensitivity both rate very high. Weak signals on 10 meters were copyable, and the very crowded 75 meter band at night was easily sorted out. Using the PBT made signal sorting very easy.

Note: This evaluation was completed during the summer months when QRN is very prevalent. I found that the IC-728 handles high levels of static very well.

Receive audio was very good, even when using the internal speaker. It improved, however, when I sent the audio to a large external speaker (as would that of nearly any receiver).

Comments about the XMIT audio quality were not as positive as those about receiver performance. Audio was described as weak and without authority. I corrected this by changing from the standard microphone to the SM-8 (ICOM) and making tone adjustments to it. I was then able to duplicate my typical IC-751A or Corsair II signal, and comments were then very favorable.

A keypad, such as the one optionally available for the IC-751A, would be a good addition. I rarely use memory features, but I do enjoy the ease of keypad frequency entry. Perhaps a third party will develop a workable solution to this deficiency.

The display is very readable and the controls are well laid out for ease of operation. The switches and controls are large enough to be easily usable.

The size of the IC-728 is such that it will easily fit in most mobile situations. An automatic antenna tuner would be perfect for this operation.

For the evaluation I used an Astron 35-amp power supply, as the IC-728 does not have a built-in AC power supply. The antennas I used included the Cushcraft R5, a two-band dipole, and a 160 meter Carolina Windom.

Recommendation

The ICOM IC-728 performs top-of-the-line and is operationally comparable to the high-priced rigs, but the price is way-down-low.

I recommend the IC-728 and feel confident the investment will be returned with many years of reliable enjoyment.

Model IC-729

ICOM foresaw the recent demand for 6 meter transceivers by adding coverage from 50 to 54 MHz to the IC-728 and calling it an IC-729.

Six meter power output is 10 watts on SSB/CW/FM and 4 watts on AM. A tone encoder is included. The 729 weighs about 10.8 lbs. and costs about $300 dollars more than the IC-728.

Specifications

General
Receive frequency coverage:
500 kHz-30 MHz
Transmit frequency coverage:
1.800- 1.999 MHz
3.500- 4.000 MHz
7.000- 7.300 MHz
10.10- 10.150 MHz
14.00- 14.350 MHz
18.068-18.168 MHz
21.000-21.450 MHz
24.890-24.990 MHz
28.000-29.700 MHz
Modes: SSB/CW/AM*/FM*
(* AM and FM require optional UI-7 on IC-728)
Memories: 26
Antenna impedance: 50 ohms
Usable temperature range: 14 to 140 degrees F
Frequency stability:
<±200 Hz first hour
<±30 Hz at 77 degrees F
<±350 Hz over 90 degree F fluctuation
Power requirement: 13.8 VDC (20 A on XMIT)
Dimensions: 9.5 x 3.7 x 9.4 inches (WHD)
Weight: 10.1 lbs.

Transmitter
Output power
1.8-30 MHz
SSB/CW/FM:100W
AM: 40W
Spurious emissions: <-50 dB
Carrier suppression: >40 dB
Unwanted sideband suppression: >50 dB
Microphone impedance: 600 ohms

Receiver
System: Triple conversion superheterodyne
IF frequencies: 70 MHz/9 MHz/455 kHz
Sensitivity (preamp on):
0.5-1.8 MHz
AM <13.0 µV/10 dB S/N
1.8-30 MHz
SSB/CW <0.16 µV/10 dB S/N
AM <2.0 µV/10 dB S/N
FM (28-30 MHz) <0.5 µV 12 dB SINAD

Selectivity:
SSB/CW
>2.1 kHz/-6 dB
<4.0 kHz/-60 dB
AM
>6.0 kHz/-6 dB
<20 kHz/-40 dB
FM
>12 kHz/-6 dB
<30 kHz/-50 dB
Spurious and image rejection: 70 dB
Audio output: 2.6W at 8 ohms
RIT range: ±1.2 kHz

Options Available
AM/FM Unit (UI-7) is required for AM transmit and FM operation in the 10 meter band.
ICOM offers an automatic antenna tuner (AT-160) which attaches to the side of the IC-728. It receives its operating power from the 728.
For mobile operation the AH-3 HF Automatic Antenna Tuner is available. This particular tuner is designed for remote mounting (ie: in the trunk).
An automatic antenna selector (EX-627) is also offered that switches antennas based upon the frequency of operation. Manual over-ride is included.
Many other options are available (see your local dealer or send to ICOM for more information).

Availability
The ICOM IC-728 is available from most amateur radio sales outlets. The suggested retail price is $1,099 although the street price will probably be less.

73 Review

Number 7 on your Feedback card

by David Pelaez AH2AR/8

The Micro-Mag Mobile Antenna

Compact VHF and UHF antennas for the ham on the go!

Pro-Am by
Valor Enterprises
185 West Hamilton St.
West Milton OH 45383
Telephone: (513) 698-4194
Price class:
MM144 (2m): $43
MM450 (440 MHz): $43
MM270 (2m & 440 MHz): TBA

Photo A. The Valor Mobile Antennas Micro-Mag series. Pictured is the 2-meter version (MM-144).

There is one word that describes these new antennas that Valor Enterprises has recently created . . . SLICK!!!

During a recent visit Gerry Stephens W8LLW showed me a prototype mobile ham antenna he had just finished that was going to be added to the Valor Pro-Am line. As Gerry is VP of engineering at Valor, his amateur radio background has helped keep amateur radio products within the company catalogs.

The unusually small size of this mobile antenna makes it quite unique. As I examined it for the first time, I was amazed at the overall size and weight of this magnet-mount antenna. The whole antenna, magnet mount, transmission line and BNC connector tips the scale at under two ounces! How would such a diminutive magnet hold under the buffeting of passing semis and turnpike speeds? Gerry told me, "See for yourself!" Since he knew that I was preparing for the trip down to Florida, what better test scenario would there be?

How Did They Do It??

In an ABS injection-molded base only slightly larger than a Hershey's "Kiss," Valor has added a rare earth magnet. This extremely powerful magnet, made of a Neodymium-Iron-Boron compound, forms the heart of the MM series mobile antennas. Its size, weight and magnetic strength make it a real powerhouse. Valor didn't stop with quality materials at the base. The antenna itself is made from a 17-7 pH stainless steel 0.046" rod that has been black-chromed. A 9-foot run of RG-174 coax is used to compliment the diminutive base, and the line terminates into a strain relief type BNC connector. As this system was designed for taking on and off vehicles as a pack-away antenna, the antenna's power rating is 50 watts (determined by the use of RG-174) for the 2 meter version (and the 2 meter portion of the dual-band antenna), and 35 watts when using the dual-band antenna on 440 MHz.

Road Test

Take care when placing the antenna mount on a painted metallic surface. The magnet is very powerful so there will be a tendency for it to pick up all sorts of stuff. There is nothing quite as abrasive as the fine grit the magnet seems to find when it is off the vehicle. A careful wipe of the base's footprint with a clean towel,

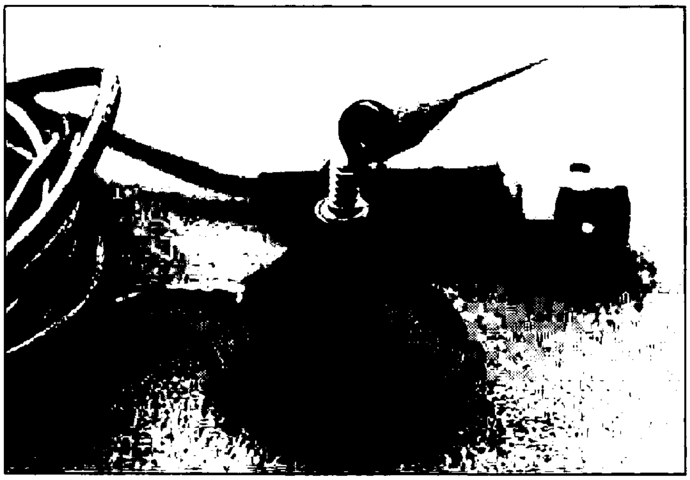


Photo B. The threaded brass connection allows for quick changing of the whip. The BNC connector is shown for size comparison.

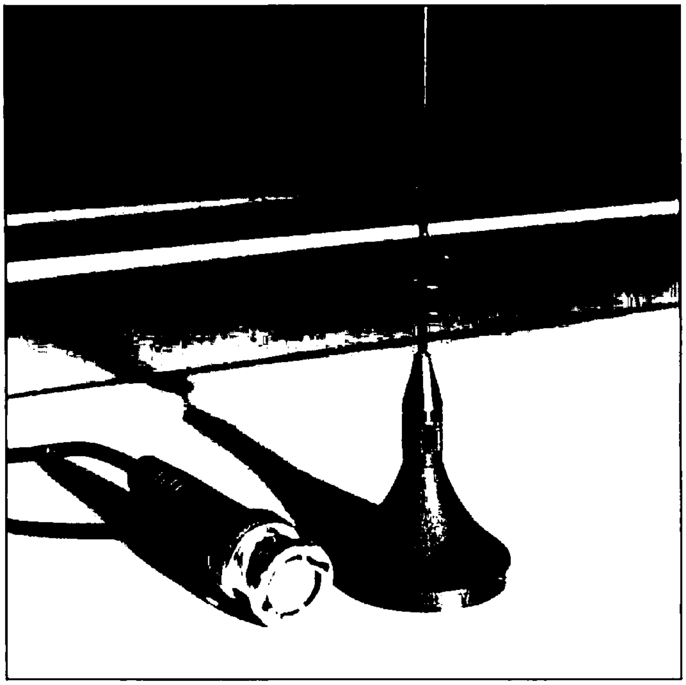


Photo C. The MM-270 dual-band version. The miniature base holds up even at high speeds thanks to a rare earth magnet in the base.

along with a close inspection afterward will insure that you won't drive any iron filings into the paint on the ol' steed. As odd as it sounds, I found that the magnet was so strong that it would attract the very fine copper wires from past coax soldering projects. The tinned copper strands from the braid had enough ferrous tin plating on them to become magnetic. Also remember to tip the base and lift straight up in order to remove it from a surface . . . don't try to slide it off . . . or sscccr-raaatttccchhh!!!

After logging over 3,500 miles in 28 days, the quarter-wave MM144 faithfully stayed in place and budged only when I took it off to put it on another vehicle. The convenience of having a quarter-wave miniature 2 meter antenna for instantaneous use on any of the vehicles we were using really spoiled us. Usually, the thought of lugging around coiled-up RG-58 and a large magnet mobile antenna would be enough for us to intentionally forget it. If ever there was such a thing as a perfect idea . . . this was it. No more iron ballast for this chap!

Some More Good Points

As a frequent flier, I also see the advantage of this mobile antenna for briefcase packing. The MM270 becomes the perfect companion to a dual-band handie talkie while using rental cars. Additionally, its extremely low-profile design makes it virtually invisible from 30 feet away.

Both antennas will be available by the time this article is published. The dual-bander will be much like its little brother—it will be a quarter-wave antenna (unity gain) for 2 meters, but it will also perform as a 5/8-wave antenna (3 dB gain) on 440 MHz. Valor has done its homework on trimming these antennas right the first time: As there are no user adjustments on these stainless steel antennas, Valor has insured that they are cut to tolerance so no tuning is required.

The 2 meter version that I field-tested showed a very flat VSWR across the 2 meter band. As a matter of fact, the Smith Chart from the Network analyzer reveals a bandwidth of nearly 23 MHz at less than 2.0 to 1. This antenna covers a good slice of the VHF public service band, with the SWR "trough" centered around 146 MHz. The highest reading at any one given point on the 2 meter amateur band was 1.4 to 1, and it was almost flat near 146 MHz.

The Drum Roll, Please!

I have never seen a magnet-mount mobile as slick as this one. If you are looking for an extremely high quality magnet mount antenna, the size of a flea but with the grip of a gorilla, Valor appears to be the only company producing such a beastie. Gerry says that there are some European cellular phone antennas that have this low a profile, but it looks like Valor is the first to come up with this concept for amateur use in the United States. I am most certain it will become a very popular antenna! Just don't forget to eat your Wheaties before you remove it! 73

Is 2 Meters Hazardous to Your Health?

How to calculate safety.

by Paul Danzer N1II

One day this could be the label on your new handie-talkie. Far-fetched idea? Well, maybe not. According to the latest radiation safety standard expected to be issued by the American National Standards Institute, we could have a problem.

A Few Definitions

The American National Standards Institute (ANSI) is a group devoted to establishing standards for both industry and government. It uses working groups of engineers, technicians, and university professors to determine what should and should not be included in these standards.

Let's begin with the conclusion. According to the ANSI specifications, we are OK. It says that unless the antenna is placed and kept next to your skin, transmitters of 7 watts or less (at 146 MHz—2 meters) are exempt. So technically our handie-talkies and little rubber duckies don't pose any problem.

But just in case—since 7 watts is not inscribed in stone as the eleventh commandment—suppose that one provision did not exist. If we calculate the field strength to which we are exposed, just how bad is it?

The power radiated from a test case of a handie with a rubber duckie depends on a host of not very well controlled things: the efficiency of the rubber duck, the effective ground plane of the body of the handie and the conductivity of our arms, among other factors.

What Do the Specifications Say?

Before starting, we have to look at the specifications and see what they say. When do we know we have a problem? For 2 meters, the 144-148 MHz band, the warning bell rings at an average power density of 1 milliwatt (mW) per square centimeter. This is the same as about 6.5 mW per square inch.

This number is calculated by taking the power out of an antenna and dividing it by the area irradiated by the antenna. If you have 10 watts coming out of an antenna, and somehow all of the power hit an area of one square inch, the average power density would be:

$$\frac{10 \text{ watts}}{1 \text{ square inch}} = 10 \text{ watts per square inch}$$

How Strong is the Field of a Rubber Duckie?

Let's take a six-inch-long rubber duckie as our antenna. We know that we are interested in distances close to the antenna—in the "near field"—and we also know the duckie will radiate in all directions pretty equally. No power comes off the ends of the antenna; instead, the power coming out looks like a cylinder, six inches high, centered on the rubber duck. (See Figure 1.)

Armed with the formula for the area of a cylinder—Area = 2 x pi x radius x height (six inches)—we can take the total power of 1 watt and divide it by this area to get the power density at various distances from the duckie.

The curve in Figure 2 does this for us. At three inches we are up at 9 mW per square inch, and we don't get below the 6.5 mW per square inch level until four or five inches away from the duckie.

Are We OK?

I don't know about you but my rubber duckie is a lot closer than four or five inches from my head, so we had better take a little closer look.

The value calculated for three inches and the perfect rubber duckie is 8.84 mW per square inch. A real rubber duckie is not perfect, and we all know that some of them are closer to a dummy load than an antenna. But some are not bad, and a good guess is that instead of being perfect we can claim that the duckie will produce a field strength that is about 2 dB lower than perfect.

A value of 2 dB reduces the field strength by a factor of 1.6, so at three inches we can consider the power density to be reduced to about 5.5 mW/square inch. Since this is lower than the ANSI specification value of 6.5 mW per square inch, we are probably OK.

Three inches is a good guess. Looking at a

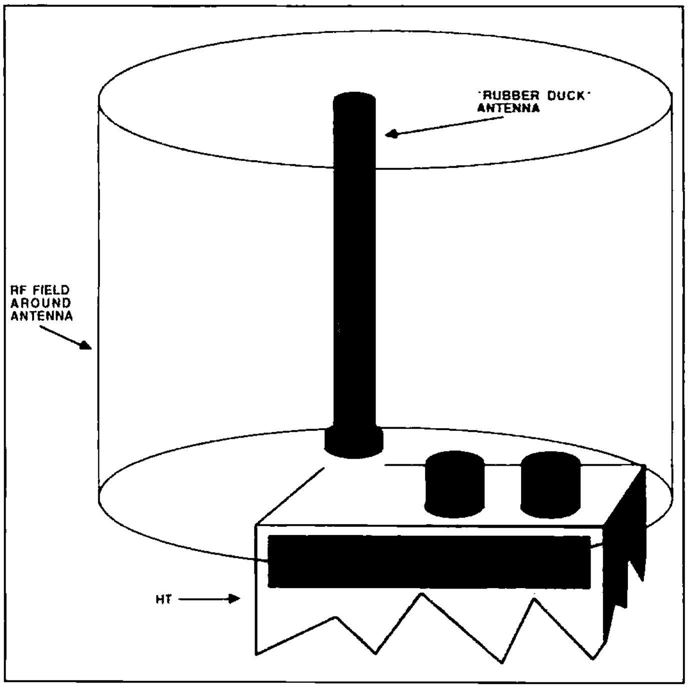


Figure 1. The near field for a rubber duckie antenna.

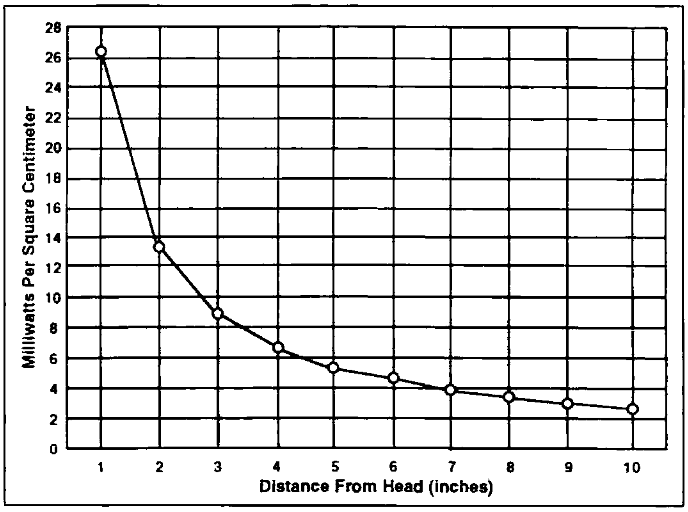


Figure 2. Power density vs. distance from the duckie antenna (1-watt transmitter).

real case (as shown in Figure 3), the handie is usually at an angle and seems to vary from perhaps two inches from the users head at the bottom to five inches away at the top. You can take your own guess and change the numbers accordingly.

Long-Winded Operators

The ANSI specifications have another provision which we should consider. It says that the power is averaged for each six-minute period. In our real case you can take the time that the transmitter is on, divide it by the time it is off (with six minutes maximum for the total on/off period), and use this factor to reduce the average of the field strength. Why a six-minute period? It is probably related to heating effects in meat (your head and my head), but in any case we have a practical solution.

Suppose three of us are on the repeater, with a long time-out setting. If each of us talk for two minutes, the on time is then two minutes out of six, or 33%. Therefore, we can take the 5.5 mW per square inch calculated before, take 33% of it, and come out with a nice safe 1.8 mW per square inch.

Higher Power Handie-Talkies

Up until now we were basing our numbers on a 1-watt handie-talkie. Suppose you are using a 5-watt unit. This would produce 5 x 1.8, or 9.2 mW per square inch—over the limit!

Or suppose we are using one of those new battery packs that provide 12 volts and maximum power—8 watts or more. Now we do have a real problem.

All of this was based on general calculations. Unfortunately, our use of handie-talkies is such that we seem to keep them close to a very vulnerable organ—our eyes—and this is probably one of the worst positions in which to put a radiating source.

Conclusion

After all of this, what can we say? Sorry, but in this increasingly complex world there is no single, simple answer. As you have seen, making a few approximations by using arithmetic comes out with some numbers which strongly suggest that a few precautions are in order:

- Keep the antenna away from you.
- Use the lowest power possible.
- Keep the duty cycle low—talk little, listen a lot, or at least don't be long-winded.

Is the handie safe? So far as we can tell, it can be used within the ANSI limits. As with almost anything in this world that you enjoy, you can take it too far, abuse it, and get into problems. But for now I am going to keep using my rubber duckie on my daily dog walks—and cutting it back to the low power position whenever possible.

Credits and Apologies

The people who put together the ANSI specifications had a very difficult task, and we can only be grateful for their efforts. To get a copy of the specifications ("American National Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI C95.1-1990), contact: The Institute of Electrical and Electronic Engineers, 345 East 47th Street, New York NY 10017. Ask for the latest revision available.

Footnote for other VHF/UHF/microwave bands: The specifications provide a limit of 1 milliwatt per square cm for the frequency range of 100 to 300 MHz. For 3000 MHz on up the limit is 10 mW per square cm. In between, from 300 MHz to 3000 MHz, the limit is given by the formula f/300 where f is in MHz. Therefore, for operation on 450 MHz the allowable limit would be 450/300 or 1.5 mW per square cm. At 900 MHz, the result is 900/300 = 3 mW per square cm.

The low power or 7-watt exclusion applies to all transmitters operating between 100 kHz and 1.5 GHz. Additionally, there is some loosening of the requirements for partial body exposure. However, these "easier" numbers are not applicable when the part of the body includes the eyes or testes.

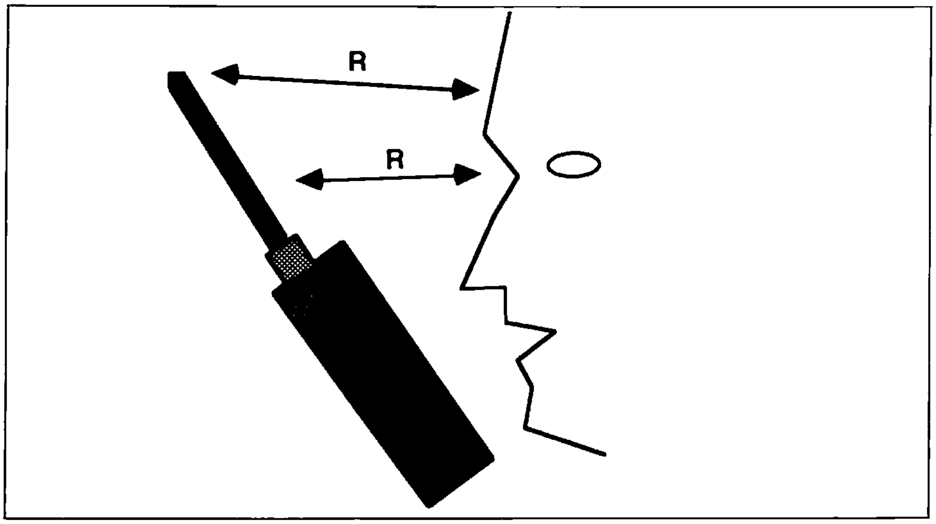


Figure 3. Typical operating positions put the antenna about 2 inches from the head at the base and about 5 inches away at the end.

Build a LiTZ Decoder

Touch-tone control your speaker for emergency alerts.

by Paull Holmes KA5RZI and Marshall Macy N7IOB

Although not universal, LiTZ (Long Tone Zero) appears to be the method being adopted by most as the amateur radio standard for urgent or emergency traffic. A number of amateur radio clubs, as well as the ARRL, have endorsed LiTZ as a standard. In many areas, LiTZ-equipped receivers are monitoring 24 hours a day and held silent by a LiTZ decoder until a request for help is received. When an amateur needs help, he/she simply plays a DTMF (Dual Tone Multi-Frequency) zero for approximately six seconds and the decoders are activated, and speakers are then connected to the monitor receivers.

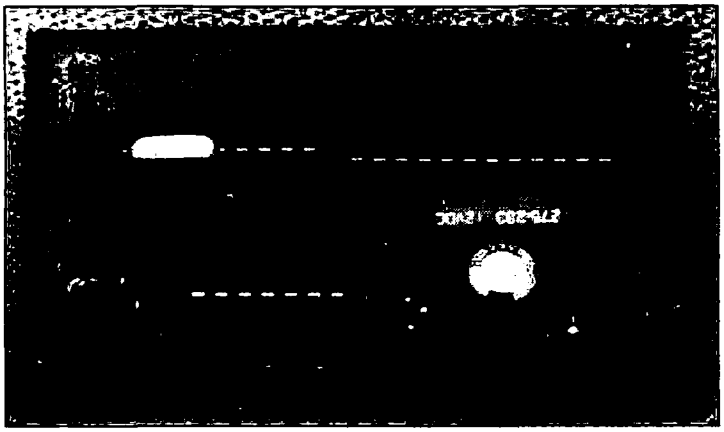


Photo A. Completed LiTZ decoder and one of the prototype circuit boards.

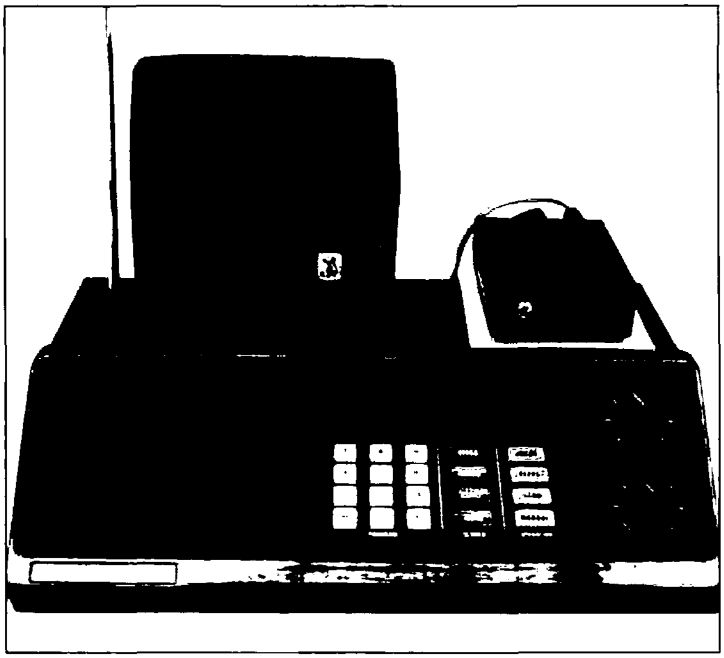


Photo B. The LiTZ (Long Tone Zero) decoder in service using a flea market scanner and mobile speaker.

Overview

There are a number of advantages to the LiTZ signaling method. The technology is reliable, it does not require any modifications to the receivers (or to local repeaters), and it's inexpensive. Almost all amateur 2m transceivers are equipped with a standard DTMF Touch-Tone pad, hence are LiTZ-"ready" to send a request for help.

A search through amateur radio magazines indicates that the LiTZ method is not new—we found several different construction articles dating back 10 or more years. As with most electronics, the construction difficulty of a reliable decoder has been sharply reduced in recent years because of the elegance of the ICs available for specific tasks.

It occurred to us that perhaps one of the reasons that LiTZ has not been adopted on an even wider scale is the lack of an inexpensive source of the decoders. This construction article is an attempt to make LiTZ more available.

Any receiver (transceivers, scanners, etc.) can be used as a LiTZ monitor because this decoder is simply installed in the speaker lead, with absolutely no modifications to the receiver. It uses a crystal-controlled decoder chip and will decode any of the 16 standard DTMF tones including the standard 0 tone. The decoder requires only one non-critical adjustment to adjust the timing interval to about three seconds of tone to activate the speaker circuit.

Theory and Construction

A LM324 quad op-amp is used (see Figure 1). One section (D) amplifies the incoming audio. This amplified signal is fed to an SSI-202 chip which decodes the DTMF to a four-bit binary value that passes to the 4515, which decodes the four bits to one-of-16 that corresponds to each of the 16 possible DTMF tones.

The 4515 is an active low device, so one output will go low when a DTMF tone is decoded. When the selected output goes low, it is connected through D5 to pin 3 of the LM324. The output of this section also goes low and allows capacitor C7 to begin discharging through the resistor network R9 and R10. When the voltage on C7 decays to less than the reference voltage on pin 5, the output of this next section goes to approximately 12 volts and applies a positive voltage to the gate of the SCR (2N5060) which latches it on. The SCR causes the relay which connects the audio to the speaker to close. The SCR also turns on a red LED (a flashing variety) so that there is also a visual indication of the LiTZ alarm.

Other tones may also be connected to E7 through a small signal diode (1N914) to the desired tone pin of the 4515 if more than one tone should be decoded in the LiTZ fashion. This might be useful if a "local" alert signal as well as the standard zero is desired. Note that the tones are NOT decoded in sequence; this arrangement just allows the decoder to "listen" for more than one tone.

To expand a bit on the idea of strapping the decoder for tones other than 0, let's consider the possibility of having your decoder respond to some other digit, say the number 2. This would allow you to latch the decoder by transmitting the digit 2, but this digit 2 tone would not activate other true "LiTZ" decoders in the service area of the repeater. As use of this system grows in a service area, tone assignment coordination will probably be required, but the the addition or changing of the tone is a simple matter and entails no parts expense other than an inexpensive small signal diode needed for each digit to be decoded. Solder points E5, E6, and E7 are provided to accommodate diodes to the output pins of the 4515 IC which corresponds to the digit(s) that you wish to add to your list. It is possible to "strap" as many digits in this manner as you wish.

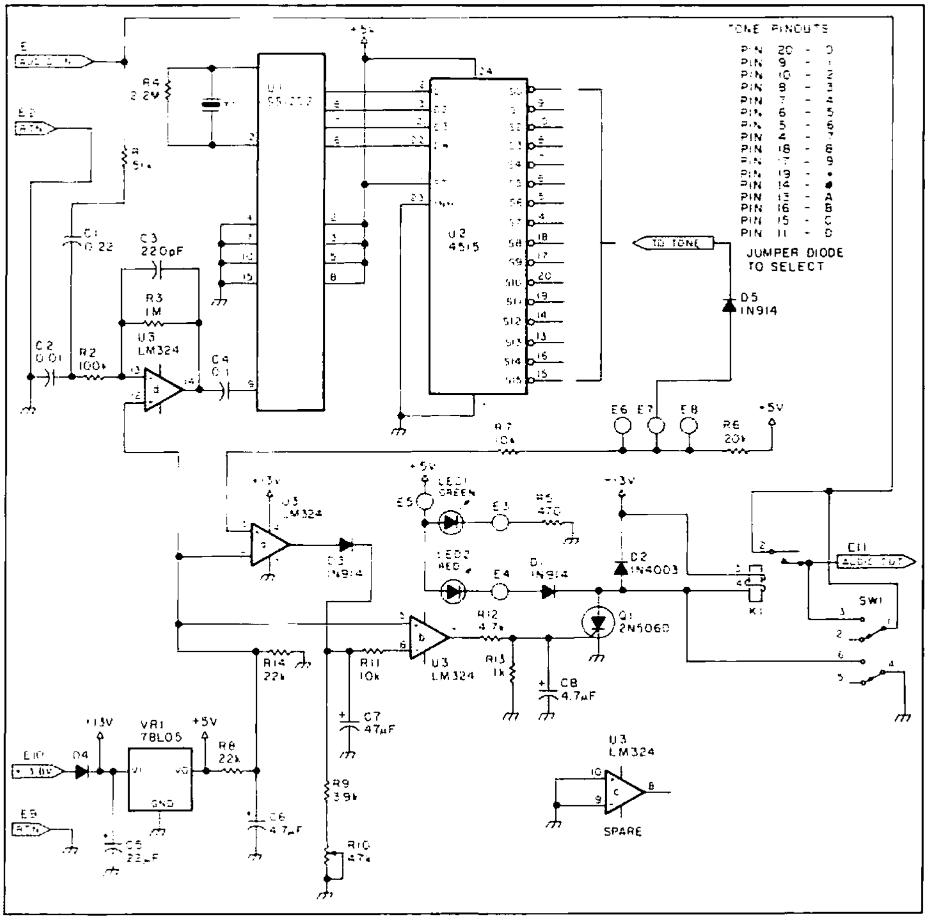


Figure 1. Schematic for the LiTZ decoder.

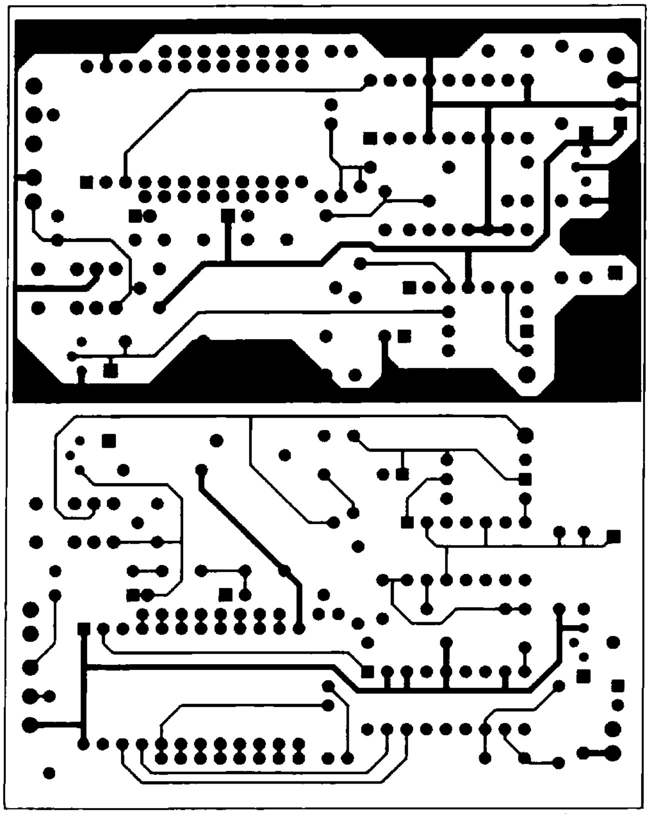


Figure 2 (a). PC board foil pattern for the component side. (b). PC board foil pattern for the solder side.

Construction is straightforward. The project can be wired on a small perf board, or you can make your own PC board, or order one of the several kit options available. A 78L05 three-terminal voltage regulator provides the +5 volts for the SSI-202 and the 4515 chips. This regulated +5 volts is also used to establish the reference for the comparitors (sections A and B of the LM324) used for the timing. A DPDT switch is used to bypass or reset the decoder. An SPST switch would work to reset the decoder, but we wanted to be able to bypass the decoder even if it was not powered.

We built our decoders into small Radio Shack boxes (270-293) (see Photo A). The partition, inside the box for the battery, is scored and removed; the circuit board is held by small pieces of foam weather strip on the sides of the box. The board just fits—simply place the weather strip along the sides of the box and press the board into it. It is *not* possible to use the screws provided to hold the box together—we simply used small strips of electrical tape along the side

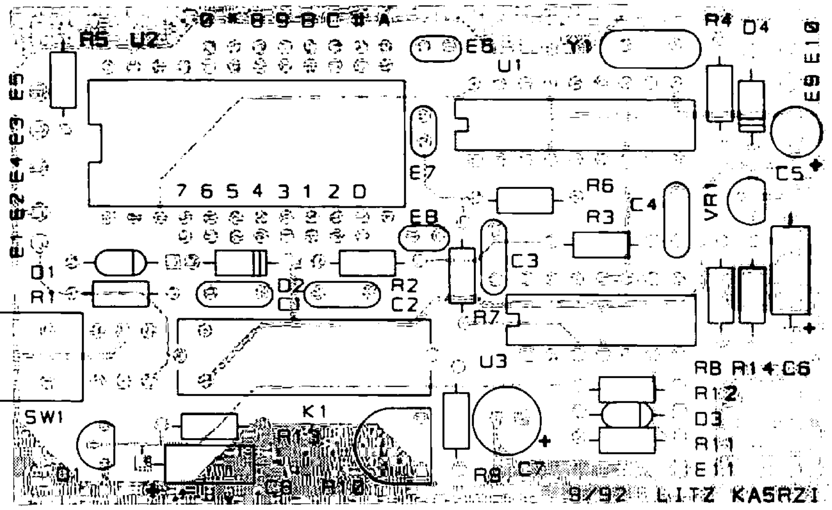


Figure 3. Parts placement diagram. (If you make your own PC boards, you will need to solder leads on both sides where necessary. This won't be necessary if using the board available in the parts list since it has plated-through holes.)

seams of the box. This doesn't sound very elegant, but it seems to work very well and even looks fine. Drilling and fitting the pieces into the box is somewhat tedious and probably takes as much time as the construction of the electronics, but the results produce a fine-looking decoder.

Parts List

R1	51k
R2	100k
R3	1meg
R4	2.2meg
R5	470Ω
R6	20k
R7,R11	10k
R8,R14	22k
R9	3.6k
R10	47k trimpot
R12	4.7k
R13	1k
C1	0.22 µF 50V
C2	0.01 µF 50V
C3	220 pF 50V
C4	0.1 µF 50V
C5	22 µF elec. 16V
C6,C8	4.7 µF elec. 10V
C7	47 µF elec. 16V
D1,D3,D5	1N914
D2,D4	1N4003
U1	SSI-202
U2	4515
U3	LM324N
Y1	3.5795 MHz color-burst crystal
VR1	78L05
Q1	2N5060 (SCR)
LED1	Green LED
LED2	Red LED (flasher)
K1	12-volt reed relay
SW1	DPDT sub-mini switch

1/8" phone plug & jack
All resistors 1/4 watt 5%.

Kit Options
Etched and drilled PC board: $9.95
Board and SSI-202 IC: $16.95
Complete kit of parts: $36.95 (excluding box)
Complete, wired & tested: $56.95 (including box)
Available from: Marshall Macy N7IOB, 8615 E. Apache Trail B-39, Mesa AZ 85207.
Tel.: 1-800-484-9691, code 7373.
Please add $2.00 postage/handling per order.

The only adjustment on the decoder is R10, which determines the amount of time that the DTMF tone must be received before the decoder latches. Normally, the timer is set for about three seconds; LiTZ users are advised to "play" the tone for six seconds to make sure the decoders hear it. Pushing the 0 for the longer time also makes the LiTZ receiver sound about three seconds of tone as an audible alert signal after the speaker is connected.

When completed, the decoder requires an external speaker and a low current source of +13 volts. We used an old $15 flea market scanner that I had on hand as the LiTZ receiver (see Photo B).

This old scanner even has a 13-volt accessory output on the back which has worked fine as a power source. Virtually any receiver will work as long as it is capable of receiving a dependable signal from your local repeater. Note: The decoder requires that the speaker of the receiver have one side tied to a common ground. If the speaker floats above ground this decoder will not work. Also, an external speaker output must be available on the receiver.

There is a possible trap: I considered building my first version of the decoder into a mobile speaker box; however, this decoder uses a reed relay which would be affected by the magnet in the speaker. To use this decoder in a speaker box would require protecting the relay from the magnetic field.

My own decoder has been active for several months, has never had a false decode, and has never failed in a test. Even very noisy signals through our local repeater have decoded flawlessly.

Fortunately, I have never received a true "LiTZ" emergency, but I am ready! I hope that many other LiTZ receivers go "online" and listen for . . . hopefully not . . . me! ■

Iambic Keyer Paddles

A wide array of choices.

by John L. Rehak N6HI

These days, the majority of active CW operators on the bands are using iambic keyers, also called squeeze keyers. A keyer is an electronic circuit that can automatically produce a continuous string of dots while one paddle contact is closed, and a continuous string of dashes when the other paddle is closed. An iambic keyer takes this technique a step further: If *both* paddle contacts are closed simultaneously, the keyer will produce a string of alternating dots and dashes. What this means is that many characters (those that contain alternating dots and dashes, such as R and C) can be formed by a single "squeeze" of the paddle.

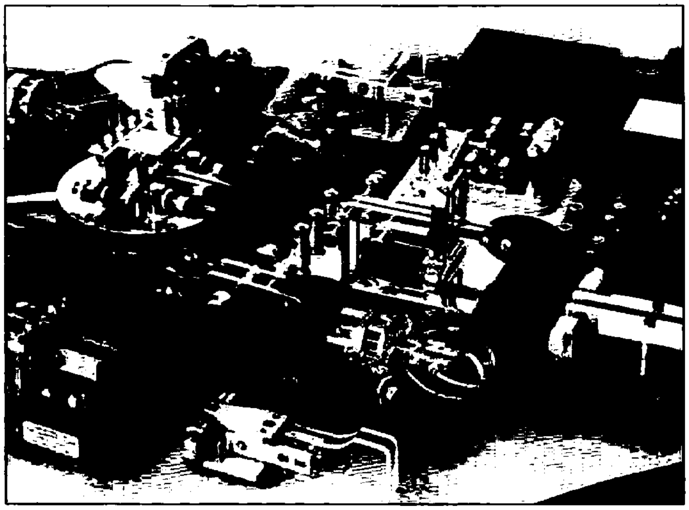


Photo A. Iambic keyer paddles are available in a wide variety of shapes and sizes. Photo by N7YVK.

Any paddle simply consists of two switches which are used to control the keyer. An iambic paddle is one that allows the operator to close both switches either separately or simultaneously, to allow for "iambic" keying.

Why Iambic?

Iambic keying translates into more efficient and less tiring operation for the CW operator because some characters can be formed with less movement. If you are moving up to an iambic keyer from a hand key, bug, or a non-iambic keyer, you may find that the new technique will take a little time to get used to. It is well worth the effort, though, because you will be able to send at higher speeds and with less effort.

Most keyers available commercially today are iambic. To be able to use the iambic mode of these keyers you must have an iambic paddle, or "squeeze paddle." Most paddles available today are iambics, but you will still find non-iambic or "single lever" paddles available from Bencher, Vibroplex, and others. I highly recommend that you invest in a good keyer and iambic paddle. It will certainly enhance your enjoyment and proficiency at working CW . . . and iambic keying is fun!

What to Look For in a Paddle

There are many iambic paddles available today, some better than others, and I highly recommend that you try several if possible before making a purchase. Here are a few general suggestions of what to look for in a good iambic paddle:

Feel This almost goes without saying, but if you try various paddles, you will certainly find that the "feel" of the paddles varies tremendously. Some have a light touch, some are stiffer or more sluggish in response, and some even have a "clunky" or sloppy feel. A good paddle should feel very smooth and precise, and not ever make you feel like you are "fighting" it.

Weight When it comes to the weight of a paddle, the heavier the better! If a paddle does not have a base that is heavy enough, it will tend to slide or "walk" around on the tabletop as you use it. Many CW operators have been known to use double-sided tape or rubber cement in an attempt to tame a walking paddle! Get a heavy one, especially if you are a "heavy hitter," and you won't have to resort to tape or glue to keep your paddle in place in the heat of a pile-up or contest when the going gets fast and frantic!

Adjustability Ideally, contact spacing and tension ("return force") should both be independently adjustable for each side. As a minimum, contact spacing should be separately adjustable for both dot and dash contacts, and tension should at least be adjustable for both sides together—separate is better! A few paddles also allow adjustment of the spacing between the finger pieces, which will allow you to custom tailor the spacing between thumb and finger levers to your preference.

Almost all paddles allow you to adjust contact spacing and tension, but the range of adjustment varies tremendously. The ideal paddle will allow contact spacing to be easily adjusted from "way too close" to "way too wide," and tension to be adjusted from "way too light" to "way too heavy"!

Another factor to consider is the means by which the adjustments are made. Some paddles require tools to adjust and some do not. The advantage of having a paddle that adjusts without the need for tools, such as by using thumbscrews, is that you can make adjustments any time or any place. There may also be an advantage to having a paddle that does require tools to adjust: The adjustments would then be considered somewhat more permanent, and if you would prefer that others not disturb your favorite settings they are a lot less likely to do so if the adjustment requires an Allen wrench which is in *your* pocket!

It is important that a paddle not only be adjustable, but that the exact settings you make will hold their positions well over a long period of time. Some paddles will tend to drift away from your favorite settings, which can be annoying.

Contact spacing on some paddles can be adjusted so close that even the slightest touch will activate the contacts. With others, you may find that if you attempt to set the contact spacing too close, the paddle will exhibit "bounce back": When you hit one side fairly hard, the contact will close, but then the other side will bounce back and close its contacts, which will cause you to make sending errors.

Connections Different paddles require different means to attach the cable that connects the paddle to your keyer. Some require that you solder the cable to the underside of the paddle. This method has its pros and cons. The plus side is that the paddle cable is permanently attached so it won't get separated from the paddle and lost. On the minus side, if the cable develops a problem you will need to have a soldering iron available to repair it.

Other models have binding posts or thumbscrews which allow you to connect cables without soldering. At least one model has all the connections completely enclosed inside the paddle's base. This makes for a neat appearance and eliminates the possibility of shorting the connections if the paddle is

set down on an irregular-shaped conductive surface. It will also prevent you from becoming part of the circuit if you are operating mobile with the paddle on your lap!

One manufacturer in England provides a jack mounted directly on the paddle base to simply plug in a cable to connect to the transmitter. I think that this is the best approach as it will allow you to easily change cables at any time. If you want to switch to a different length cable or if the cable develops a problem you can simply plug in a new one.

Appearance An iambic paddle is among the more expensive accessory items that you will purchase for your ham shack, and because it is going to be prominently located in your station it will be noticed by visitors. If you have a real "showroom" ham station, you may want a real eye-catcher for a paddle. I collect keys, bugs, and paddles, and I have a couple of older paddles, long since out of production, that can only be referred to as "ugly," but they are fun conversation pieces! Most of the paddles on the market today look pretty sharp, and a few are real works of art.

A Review of Some Specific Models

In this section we will look at currently available iambic paddles. They are listed in alphabetical order, and I have included some personal observations and comments regarding each model. See the sidebar on p. 46 for company addresses.

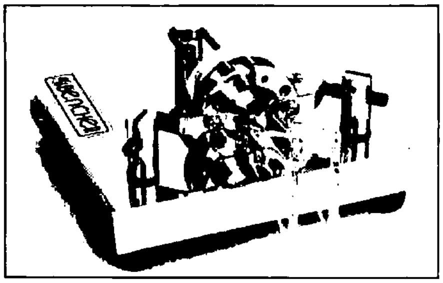


Photo B. The popular Bencher iambic paddle offers high quality with an excellent feel. Photo courtesy of Bencher, Inc.

Bencher Iambic Paddle—Black: $72.95; Chrome: $89.95 (Photo B); Gold: $250. The wide popularity of the Bencher paddle is easy to understand: It is a high quality paddle with an excellent feel at a fair price. Also, it is available at almost all amateur radio dealers. There are three Bencher iambic paddles. The low-cost model has a black base, with the top-mounted parts chromed. The black and chrome is a sharp looking combination. For $17 more you can get the Bencher with both the base and top parts finished in polished chrome. For the ultimate Bencher, there is a gold-plated model available at a premium price. The entire paddle is gold-plated, even the spring! It's beautiful.

All models of the Bencher iambic paddles are identical except for the finish. The Bencher is built on a large, thick, heavy base that helps the paddle stay put on the tabletop. The large contacts are gold-plated, which means they won't need frequent cleaning to maintain good conductivity. The Bencher paddles have a good crisp feel, with just a little "flex," owing mostly to the slightly flexible, triangular-shaped clear plastic finger pieces.

Cable connections to the Bencher are made by soldering to lugs on the bottom of the base. A strain relief is provided to keep the connections from breaking off if the cable is pulled.

There are no thumbscrews or knurled locknuts on the Bencher; you must use tools. The spring tension can be adjusted over a rather narrow range by using a small flat-blade screwdriver, and the contact spacing can be adjusted using a small Allen wrench, provided with the Bencher.

There is also a special version of the Bencher iambic paddle sold by MFJ Enterprises that consists of a standard (black) Bencher iambic paddle with a Curtis Keyer Chip keyer built onto the top of the paddle. This makes for a convenient all-in-one keyer and paddle assembly that can be handy for portable operations because of its small size. Although the keyer circuit is simple and does not include message memories or programmable feature, it does include adjustable weight and tone and offers front-panel speed and volume controls.

The Bencher is a good paddle with an exceptionally good feel and a heavy base.

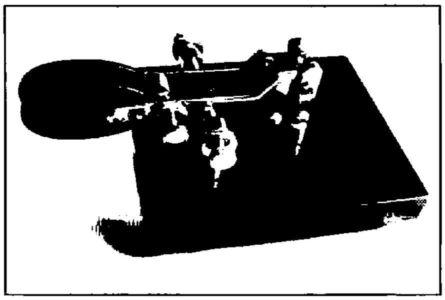


Photo C. The Ditek paddle is nearly silent in operation. Photo courtesy of Ditek Industries.

Ditek Industries Iambic Paddle—$100 (Photo C). The Ditek is a newcomer to the market, and it is a very nice paddle. The construction and appearance are similar to the old Brown Brothers paddle (no longer in production) but the base is considerably larger, thicker, and heavier. The weight, at approximately three pounds, is one of the heaviest on the market. The base is large—very thick and very heavy. The base and finger pieces are black, with the other parts polished stainless steel or chromed. The feel is excellent, very snappy and precise, with no bounce—and it stays put!

This paddle is very quiet in operation. One reason for that is the fact that the chrome thumbscrews that adjust contact spacing include a small nylon tip that almost completely eliminates any sound when a paddle is released. When it returns to the neutral position, rather than metal against metal it is metal against nylon. The support piece that holds the stationary silver-plated contacts is also made of nylon, which helps to quiet the sound when the contacts are closed. The result is that this paddle is nearly silent in operation.

The Ditek's appearance is really sharp, with clean lines and parts that are held together with stainless steel cap screws, giving the paddle a nice finished look yet allowing for complete disassembly if desired. All contact spacing and tension adjustments can be made without tools by adjusting the extra large knurled thumbscrews and locknuts. Cable connections are made to a terminal strip on the bottom with a flat blade screwdriver. A strain relief is provided.

The base surface is a powder coat, which is a process that provides a durable, long-lasting finish with an excellent appearance. Each Ditek paddle has its own distinctive serial number engraved, which is often viewed as a plus by us key collectors. Ditek also plans to offer a version of their paddle with a built-in iambic keyer mounted on the top of the paddle base. The keyer will feature a message memory that can be used for sending CQ or contest exchanges. If you always wished that you had bought a Brown Brothers paddle back when they were still being made, then Ditek is the one for you! I recommend it highly.

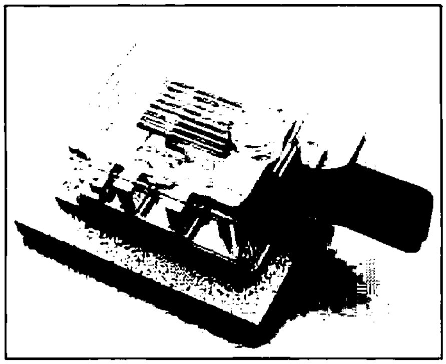


Photo D. EasyTech imports this Model MK706 from Japan. Photo courtesy of EasyTech.

EasyTech Model MK706 Iambic—$64.50 (Photo D). This paddle is manufactured by the Hi-Mound company in Japan, and imported by EasyTech in the U.S.A.

The MK706 weighs only 1.9 lbs., but in spite of its low weight it seems to hold its place on the tabletop quite well. The paddle is also available without a base. If you have the means to make your own base, you could save about $17 by getting the Model MK704 and adding a base of your own crafting.

The paddle comes with a clear plastic cover that snaps over the entire key, leaving only the paddle finger pieces and the three binding posts for the connections accessible. This keeps the paddle clean, and may discourage other operators from tampering with your favorite adjustments!

The finger pieces are large and smooth, but are very close together (less than 3/8" between your finger and thumb when the

contacts are closed). They are made out of thin plastic that has a *lot* of flex to it, which gives this paddle a "soft" feel, which some operators may prefer.

Contact spacing and tension adjustments for each side are made by knurled nuts which are difficult to adjust, although they probably hold their settings well. Contact tension is on the high side, even at its lighest setting.

EasyTech also sells another model (MK831) which is a high-end model including both an iambic paddle and a straight key mounted on a common base. This model was not available for review, but it looks interesting.

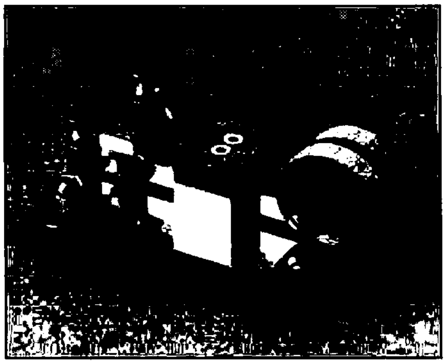


Photo E. The unusual looking Green Lake paddle from Electron Processing. Photo by N7YVX.

Electron Processing Green Lake Paddle—Wood: $89.95 (Photo E); Aluminum: $99.95. The "Green Lake" paddle is probably the most unusual looking paddle you will see. The base and top parts are both made from polished brass. The paddle is available with a choice of aluminum or wood finger pieces. Contact spacing is adjustable, but tension is not. In the model that I tried the tension was about right for my tastes, so I don't consider it a serious drawback that the tension is not adjustable.

The contacts on this paddle are simply pointed screws that make contact with the brass arms of the paddles—not true "contacts" in the normal sense, but probably perfectly adequate for use with the low keying voltage and current of today's modern keyers. This paddle has a nice feel, but it has a rather small base that is only about 5/32" thick so it will tend to slide around on the operating desk. This paddle has the most unique appearance of all I have seen, and would be a nice addition to a collection.

G4ZPY Paddle Keys International Model VHS—$135 (Photo F). G4ZPY makes several models of handmade iambic paddles. The VHS ("Very High Speed") is their top-of-the-line iambic paddle. It is an excellent paddle. The paddle is similar to the Bencher in appearance. The standard model has polished brass top parts mounted on a glossy black base. The contacts are silver, and the finger pieces are the best I have seen on any paddle. They are made from polished plastic, thicker than any I have seen on any other

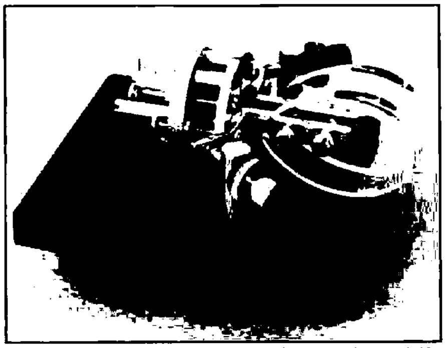


Photo F. The G4ZPY Model VHS paddle from England. Photo by N7YVX.

paddle, and are sculptured to provide a tapered shape that feels great. This paddle has almost no flex at all, owing to the thick brass arms and the extra-thick finger pieces that have no "give," resulting in a very positive "stop" upon contact closures.

Both contact spacing and tension on the VHS are adjustable without tools. The paddle adjustments are among the best I have seen, due to the fact that the adjusting thumbscrews use extra-fine threads which allow adjustments to be easily made in very small increments. The contact adjustment thumbscrews also include a small rubber washer which makes the process of making small adjustments and locking them into place smooth and easy.

The G4ZPY paddles include another nice feature that I have not seen anywhere else: The connections to this paddle are made via a small jack that is mounted directly on the paddle base. This allows you to easily plug in cables of various lengths. I wish others would do this!

The G4ZPY VHS paddle has only one drawback: The base is a bit small and light, although it seems to hold its place on the tabletop fairly well.

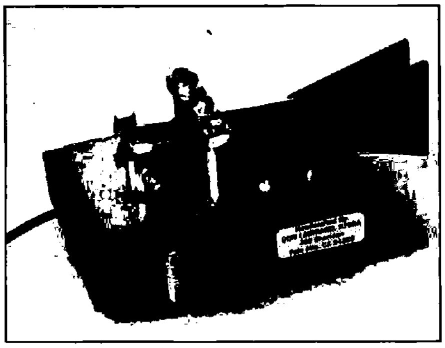


Photo G. K7SRA makes each paddle by hand. This one includes a memory keyer. Photo by N7YVX.

K7SRA Iambic Paddles—$50 to $195 (Photo G). Don Leibrand K7SRA is retired and spends some of his time making iambic paddles on a custom order basis. His paddles are machined from brass and mounted on a wood base. He has produced several different-looking paddles, some with electronic keyers built right into the base. These days he is building some with the sophisticated CMOS Super Keyer II built into it. This keyer has four message memories and a lot of clever programmable features. K7SRA's paddles have a home-built look. He personally builds and tests each one in his home shop.

Contacts, like the rest of the key, are made from brass and require tools to adjust for spacing and tension, both of which can be adjusted over a good range. The paddle "arms" are made of rather thin brass, which gives the paddle a "flexy" feel.

Over the years there have been several different all-in-one keyer/paddle combinations produced by Ten-Tec, Vibroplex and others, but I have not seen any that have incorporated built-in keyers with all the features of the CMOS Super Keyer II that K7SRA is using in his. The keyer has programmable speed, weight, messages, tone, pauses, and more, and offers automatic serial number generation for contest exchanges.

Because K7SRA custom makes each paddle and paddle/keyer combination, he can handle special requests if you want something that is a little different.

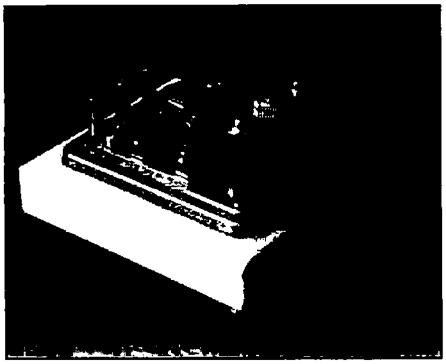


Photo H. K8XF imports this Model MK705 from Japan. Photo by N7YVX.

K8XF Telegraph Key Import Company MK-705—$129.95 (Photo H). This iambic paddle is also imported from Hi-Mound in Japan. It appears to be identical to the EasyTech paddle, with the exception that this version is mounted on a marble base. The base looks nice, and the additional weight of the marble helps keep the paddle from sliding around on the tabletop. Like the EasyTech, the K8XF paddle has high tension and knurled contact and tension nuts that are difficult to adjust, but should hold their settings well. It has a "soft, flexy" feel which some operators may prefer.

Mercury Paddle by N2DAN—$389.95 (Photo I). Each Mercury paddle is handmade to order by master craftsman and machinist Steve Nurkiewicz N2DAN. To the best of my knowledge, he does not ever advertise his paddles anywhere, although he will gladly send you a brochure describing the Mercury if you send a request.

I might as well start right off by saying that of all the paddles that I've seen, the Mercury is the clear winner, hands down. The Mercury paddle is built from solid brass. It's first nickel-plated, then chrome-plated, with a resulting finish that must be seen to be appreciated! This paddle has the

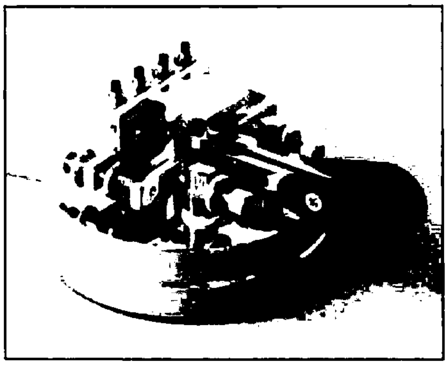


Photo I. The Mercury paddle by N2DAN with optional memory switches. Photo by N7YVX.

best plating that I have ever seen on anything that is chrome-plated! The paddle's appearance is second to none.

It is also without question the best performing paddle of all that I have tried. With this paddle it is possible to set the contacts so close that you can almost cause the contacts to close by just thinking about it! And even with the contacts set extremely close, the paddle exhibits absolutely *no* bounce-back. The contacts on the Mercury are exceptionally large, massive contacts that line up and fit together perfectly. They are solid silver, and rhodium plated.

The paddle uses rotary bearings that have absolutely no play or "slop," thus allowing absolutely no vertical movement of the paddle arms. The arms themselves are solid, massive metal in a modified L-shape, with extra-thick plastic finger pieces.

The Mercury paddle uses magnets to provide the tension for the return force. There are no springs to get stretched, lost, or slowly change your adjustments. Once set, the adjustments hold well, yet all adjustments for contact spacing and tension are easily changed without tools, using thumbscrews and knurled locknuts with extra-fine threads to allow for adjustments in extremely fine increments.

The Mercury has a massive solid brass base weighing nearly four pounds! The bottom of this heavily polished chrome-plated base is covered with a thin piece of cork. Between the sheer weight and the anti-slip cork, this paddle definitely will *not* slide around on the tabletop.

Cable connections for the Mercury must be soldered to lugs on the underside of the base. No strain relief is provided, although the size of the hole for the cable to enter the base is such that strain relief can be provided by simply tying a knot in the cable inside the base.

Because each Mercury paddle is custom built to order, Steve N2DAN will do just about anything feasible to customize your paddle to your liking. Options include engraving your callsign and allowing you to choose the color of your finger pieces from over 100 available colors, including several metallics, translucent/flex, and solids. He even offers four different shades of pink for the ladies!

A nice plus for the Mercury paddle is the availability of a custom chrome-plated remote memory bracket that mounts directly onto the Mercury. This provides four small push-buttons to control the message memories for keyers that provide memories, such as the Kansas City Keyer, the CMOS Super-Keyer II, the Accu-Memory, and others. It really is a nice convenience to be able to hit a button on the paddle to call CQ, change keyer speed, send a contest exchange, etc.

At nearly $400, the cost of the hand-made Mercury paddle is probably the highest of any paddle available today. Is it worth it? Well, that depends . . . if, like most of us, your paddle budget is limited, the Mercury may well be beyond reach. On the other hand, if you must own the very best, or if you are in a mood to splurge, I doubt if you will ever regret the purchase. The Mercury has a feel and quality unmatched anywhere, and should last a lifetime. That's a lot of CW contacts!

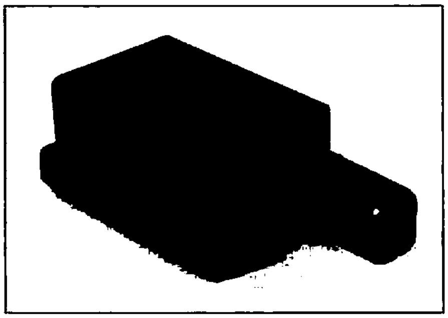


Photo J. Nye Company SSK-001 paddle with top cover in place. Photo by N7YVX.

Nye Company SSK-001 Master Squeeze Key—$51 (Photo J). The William Nye Company Model SSK-001 iambic paddle is the lowest priced of all the iambic paddles currently available on the market. Its construction is quite different from others, and so is the feel. This paddle has a U-shaped cover assembly that acts as a dust cover, and will probably help to keep others from tampering with your adjustments.

The base is die-cast, with a black wrinkle finish, and is heavy enough to hold its position on the tabletop. The top parts include two small metal angle brackets that support the contacts, which are gold-plated solid silver, and resemble the contacts that you would see on an open frame relay.

The contact tension is set by adjusting the compression of a single screw that is backed by two nuts, one to lock the other in place. Contact spacing is set by actually moving the entire metal angle bracket—one for each side—by loosening the bracket with a Phillips screwdriver, sliding the whole bracket over, then tightening the bracket down again. This procedure is imprecise, and the bracket will usually move during the tightening process, requiring you to start all over!

The cable connections require soldering to three internal solder lugs. A strain relief is provided. The finger pieces on the Nye paddle are very long—almost three inches from the pivot point to the fingertip ends, and are made from thin, hollow plastic with a lot of "give," resulting in a very "soft" feel.

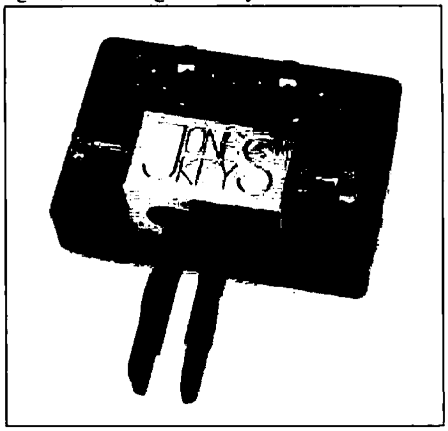


Photo K. The Palomar Engineers Jones Key iambic paddle is made in England. Photo courtesy of Palomar Engineers.

Palomar Engineers Iambic Paddle—$135 (Photo K). Palomar Engineers has just introduced a new iambic paddle, the Jones Key, imported from England. This model is new, and at the time of this writing, in short supply, but is expected to be available in quantity by the time this article appears. I have not had the opportunity to try the Jones Key myself, so I cannot comment on its feel, but I have obtained some information about its construction that may help you to get an idea of what it is like.

The base is bright red, with polished brass top parts. The paddle uses four rotary ball bearings embedded inside the brass block, which will prevent possible damage from coffee spills, etc. The paddle is reputed to have a solid "non-flexible" feel. The rear of the plastic finger pieces are rounded and, after you loosen their mounting screws, they can be rotated up or down to suit individual height preference.

The brass post between the two paddle arms at the rear of the key is oval and can be rotated to change the spacing between the paddle's finger pieces. Contact spacing and tension are each individually adjustable for dot and dash sides, using thumbscrews and locknuts that allow these adjustments to be made without tools. Each Jones Key has a unique serial number engraved in the brass block.

R. A. Kent Iambic Paddle—Kit: $70; Assembled: $85 (Photo L). This paddle is manufactured in England but is available directly from the manufacturer's sales office in the U.S.A. The Kent paddle is available as a kit or assembled. The paddle is made from machined brass and has a black painted base with brushed brass top parts. It is similar to a Bencher except that the Kent paddle uses rotary ball bearings, giving the paddle a good solid feel. The paddle pieces do not move up and down at all as they are restricted by the rotary bearings.

Spring tension and contact spacing are adjustable by thumbscrews. These are located such that they are easy to reach and adjust.

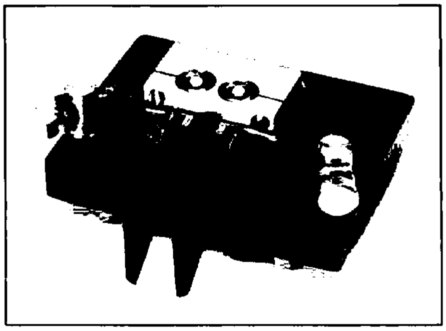


Photo L. The R. A. Kent iambic keyer paddle comes in kit form or assembled. Photo courtesy of R. A. Kent.

The adjustment range is wide, allowing plenty of room for personal preference. The paddle pieces are made from plastic that is a bit thin and has a lot of flex to it, resulting in a rather soft feel.

Connections to this paddle are made via solder lugs on the bottom of the base, with a small cable clamp provided for strain relief. The weight is a little low at 2.6 pounds, so this paddle may tend to slide on the table a bit if you are a "heavy hitter."

The paddle is ruggedly constructed and might be a good choice for a mobile paddle. It's a good choice if you have a light touch.

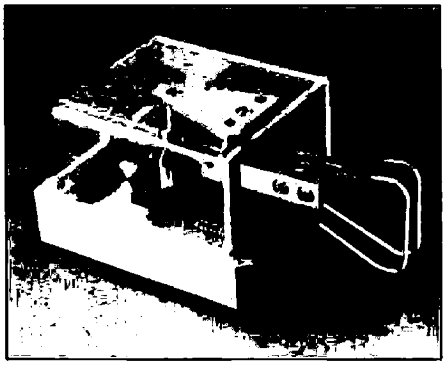


Photo M. The Schurr PROFI paddle is hand made in Germany. Photo by N7YVX.

Schurr PROFI Paddle—$180 (Photo M). Schurr Keys are handmade in Germany and are available only direct from DL7NS in Germany. It is my understanding that they are very popular in Europe. The PROFI is their top-of-the-line iambic paddle. The craftsmanship and feel of this paddle is absolutely first class.

The entire paddle is solid brass, with a unique diamond ground finish protected from corrosion by a process that the Germans call "Zaponierung." The base is heavy, with a weight second only to the N2DAN Mercury paddle. Even the bottom of the base is beautifully finished, with the same diamond ground "brushed" appearance as the rest of the paddle. This base rests on three rubber feet—the best rubber feet I have ever seen on a paddle—their bottom surface is slightly concave which provides a slight "suction cup" effect which, with the extra heavy weight of the base, insures that this paddle definitely will not slip or slide around during use.

The thick brass paddle arms are mounted on precision polished hardened steel pivots, permanently lubricated with molybdenum disulfide. The polished clear plastic finger pieces are rounded triangles. This paddle comes with a replaceable cable already attached so that the user need only supply the appropriate plug to interface with his keyer. Cable connections are soldered, and a strain relief is provided. The PROFI includes a clear plastic dust cover that snaps into place on the paddle and can be tilted up to allow access to the paddle adjustments.

Contact spacing and spring tension settings are adjusted with extra large knurled thumbscrews, using fine threads that allow for very precise adjustments in small increments. The contacts are solid silver.

This paddle is expensive, but the craftsmanship and quality are exceptional. It carries a three-year warranty, but with proper care it should last a lifetime.

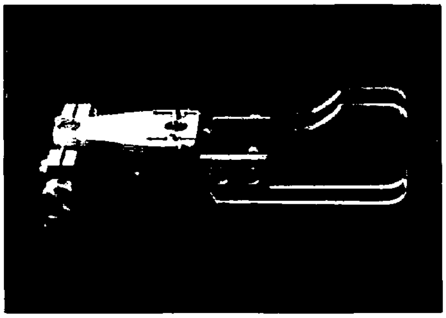


Photo N. The Schurr Mini, with no base, may be mounted in your own keyer. Photo by N7YVX.

Schurr Mini Paddle—$95 (Photo N). This is a miniature version of the Schurr PROFI paddle, and is sold without a base. You can mount the paddle on a wood, plastic, or metal base of your choice, or you may wish to build this little gem into a keyer. All that is required to mount the paddle is to drill two holes. The mounting base of the paddle is tapped for two mounting screws, which are provided. The finger pieces are large, polished clear plastic in an unusual inverted L shape.

This paddle is very small, almost what one might think of as a "spy" paddle! The paddle is made of the same beautiful diamond polished brass as the PROFI, and has an almost identical feel. Connections are made via three solder lugs, although if you mount this paddle on a base you may choose to include alternative cable connectors or a jack. Despite its small size, the Mini has a quality feel equal to that of the larger PROFI model.

Vibroplex Brass Racer Paddle—$65 (Photo O). There are actually two Brass Racers—the regular Brass Racer, and the Brass Racer EK-1, which is the same paddle with a Curtis 8044 Keyer Chip keyer built into the base.

The Brass Racer is solid brass on a hard wood base. One unique feature of this paddle is that the connections are *inside* the paddle base so that once your cable connections

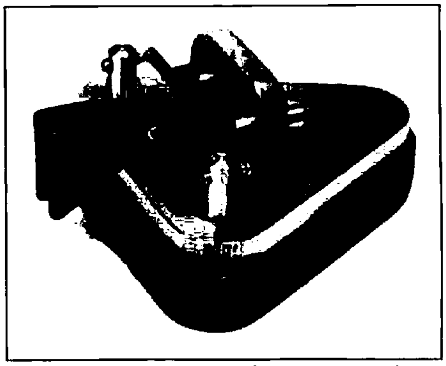


Photo O. The Vibroplex Brass Racer, shown with optional built-in Curtis keyer. Photo courtesy of Vibroplex Co.

are soldered to the paddle and the paddle is screwed down on its base, there are *no* exposed connections on the bottom of the paddle. This makes it a good choice for a mobile operator because you can lay the paddle on your lap or even on a metal surface without worrying about the electrical connections shorting out.

The tension or "return force" for the Brass Racer is provided not by springs, like most paddles, but by magnets. The magnets slide back and forth to provide more or less tension. I consider this to be a big plus because there are no fragile or delicate spring mechanisms, and because this feature allows the paddle to be easily set for a precise amount of tension, varying from "way too light" to "way too heavy."

My only surprise with the Brass Racer is the physical appearance of the paddle. The large triangular brass baseplate and top-mounted brass parts are only "brushed brass," not the highly polished or chrome-plated brass I would have expected from Vibroplex. Although its appearance is not that of the gleaming, jewel-like finish of the Vibroplex Iambic model (or several of their bugs), it is functionally one of the best.

Overall, construction is similar to the Bencher paddles, with solid-silver contacts mounted at the sides, and black plastic finger pieces. The finger piece spacing is adjustable on this model, as is contact spacing and tension, all over a very wide range, making it easy to customize the paddle to your personal preferences for spacing and sensitivity.

Because of the rugged construction and "sealed inside" contacts, the Brass Racer is my favorite for mobile CW operation. I think that functionally this is one of the best low-priced paddles on the market. It has a feel much like the Bencher but has the additional advantages of magnetic tensioning, sealed off cable connections, and rugged construction.

Vibroplex Iambic—Standard: $95; Deluxe: $115 (Photo P); Presentation: $160. The Vibroplex Iambic carries on the traditional look of the Vibroplex bugs in an iambic paddle that is available in three versions, identical in all respects except for the finish of the base: The "Standard" has a textured gray base; the "Deluxe" has a highly

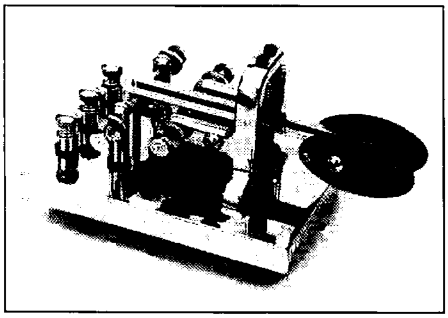


Photo P. The Vibroplex Iambic Deluxe. Note the resemblance to their bugs. Photo courtesy of Vibroplex Co.

polished chrome base; and the "Presentation" has a 24K gold-plated brass plate mounted atop the same polished chrome base as the Deluxe. All three models have highly polished chrome-plated top parts.

If you are familiar with the "bugs" (semi-automatic keys) that Vibroplex has been building for many years, you will notice how similar this paddle appears to their bugs. The base is large, thick, and heavy so this one definitely won't "walk" around on your tabletop!

The contacts are heavy gold-plated. The contact spacing and tension are both adjustable with thumbscrews and knurled locknuts, and the adjustment range is excellent for both spacing and tension, which is provided by compressed springs.

The finger pieces are the familiar polished plastic, oval-shaped finger pieces that Vibroplex has used for years as the "thumb" piece on their famous bugs. The plastic is thick and solid, contributing to the solid feel of this paddle. Contacts may be set very close and still exhibit no "bounce-back."

Connections are made via three thumbscrews located at the back edge of the base. All connections and all adjustments on this paddle can be made without any tools.

The overall appearance of the Deluxe and Presentation models of the Vibroplex Iambic is hard to beat . . . the quality of the workmanship and the heavy chrome plating give those models a trophy-like look that any CW operator would display with pride in his ham shack!

The Vibroplex Iambic may be the ideal choice for you ex-bug operators who have switched to an iambic keyer—it has a feel similar to a bug but is more precise. This paddle is beautifully built and has the classic Vibroplex look.

WB4FJJ Model 3-R Paddle—$80 (Photo Q). Mike March WB4FJJ offers a handmade iambic paddle that is similar to the Bencher but has a new twist that I have not seen elsewhere: The paddle uses magnets rather than springs to provide return force, but in a configuration that returns the paddles to the open contact position by utilizing magnetic repulsion. All other magnetic return paddles that I have seen use magnetic attraction, "pulling" the paddle back to the neutral or open position. This paddle uses two pairs of magnets, arranged such that

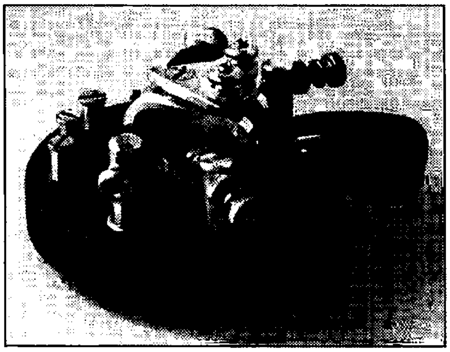


Photo Q. The WB4FJJ Model 3-R iambic paddle uses magnetic repulsion return force. Photo by N7YVX.

they "push" the paddles back to the neutral or open position.

The round base of this paddle is heavy steel, with a choice of glossy black or black wrinkle finish. Top parts are polished brass with aluminum pivots. The finger pieces are rounded triangles with a choice of plastic, ebony or pearl. Contact tension and spacing is adjusted with thumbscrews, with no tools required. Connections are made with three screwposts, requiring a flat-blade screwdriver. The paddle has a feel much like a Bencher.

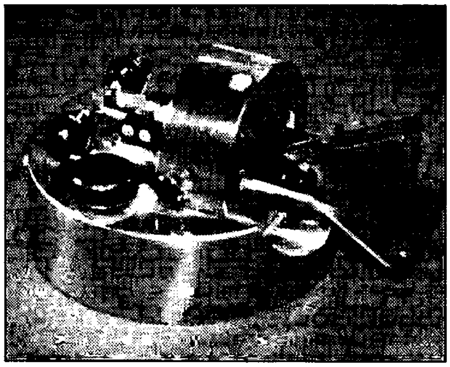


Photo R. The CW Key Siberia. This unique key (with built-in keyer) is imported from Russia. Photo courtesy of Yuri M. Sushkin of Novosibirsk-Seattle International, Ltd.

CW Key Siberia—Price TBA (Photo R).

As this article was going to press, an intriguing new Russian paddle was introduced to the U.S. Called the CW Key Siberia, this paddle comes with a built-in keyer in its chrome base. It has solid silver contact points and was produced from a former military factory.

This unique paddle is being imported by Novosibirsk-Seattle International, Ltd. in Federal Way, Washington.

Before You Purchase a Paddle

I cannot emphasize enough how important it is to *try before you buy* if at all possible. The all important "feel" of a paddle can only be determined by trying it out. Many ham dealers have paddles set up with keyers (sometimes even plugged into rigs) that you can try for yourself. If your dealer does not allow you to try a paddle out in the store (hooked up to a keyer with a monitor tone) before you buy, then find another dealer who will! If you have some ham friends who have various models, see if you can get them to let you try out their paddles, preferably adjusted to your preferences. Try a few before you make a decision, and choose your paddle carefully!

Prices vary, so take your time and shop around a bit before you choose which paddle to purchase. The current selection of iambic paddles available to you provides enough choices so that you should certainly be able to find one that fits your budget and your "fist." If you find that your enthusiasm for working CW has faded, a shiny new paddle may be just the thing to renew your interest in the historic art of Morse code!

My personal thanks to all those who helped in the preparation of this article, including several manufacturers who loaned paddles for review and answered my unending questions. Thanks to Jim N7YVX for his expert photography, to Gene N9SW who kindly loaned paddles from his personal collection and thanks most of all to my wife Shelly, who patiently put up with my becoming a "computer hermit" during the writing of the article, and for her personal time spent in proofreading and suggesting many worthwhile improvements. I'll see you all on the CW bands! 73

KEYER PADDLE MANUFACTURER LIST

Bencher, Inc., 333 West Lake Street Chicago IL 60606; (708) 238-1186.

Ditek Industries Inc., 796 Merus Ct., Fenton MO 63026; (800) 762-9328.

EasyTech, 2917 Bayview Drive, Fremont CA 94538; (800) 582-4044.

Electron Processing, P.O. Box 68, Cedar MI 49621; (616) 228-7020.

G4ZPY Paddle Keys International, 41 Mill Dam Lane, Burscough Ormskirk, Lancs., England L40 7TG; 011 44 (704) 894299.

K7SRA—Don Leibrand, 360 Sheridan, #311 Palo Alto CA 94306; (415) 327-5654.

K8XF Telegraph Key Import Company, 9929 Fox Squirrel Drive, New Port Richey FL 34654; (813) 862-6328.

MFJ Enterprises Inc., Box 494 Mississippi State MS 39762; (800) 647-1800.

N2DAN—Steve Nurkiewicz, 1385 Abner Street, Port Charlotte FL 33980; (813) 743-3139.

Nye Corporation, 12031 Northup Way, Bellevue WA 98005; (206) 454-4524.

Palomar Engineers, P.O. Box 462222, Escondido CA 92046; (619) 747-3343.

R. A. Kent Engineers, P.O. Box 809, Mt. Ida AR 71957-0809.

Schurr Key, Klaus Gramowski Kaiserin-Augusta-Allee 91 D-1000 Berlin 10 Germany; 011 49 (303) 447826.

Vibroplex Company, Inc., 98 Elm Street, Portland ME 04101; (800) 262-8387.

WB4FJJ—Mike March, 1415 Greystone Terrace, Winchester VA 22601; (703) 662-4279.

Novosibirsk-Seattle International, Ltd., 429 So. 321st Place #E10, Federal Way WA 98003-8511; (206) 661-1197, FAX: (206) 946-2719. In Russia: 630092 Novosibirsk-92, P.O. Box 4. Tel: (383 2) 46-2765, FAX: (383 2) 46-0301.

The Beach Brawley Boomer

QSOs made in the shade.

by Dean Frazier NH6XK

Having had a lot of fun building antennas, it occurred to me that my back-yard beach umbrella was an antenna waiting to talk. Some time ago I had loaded up the living room window frame, an old Toyota radiator, a photographic tripod, and a '77 Pinto bumper, all via a random wire tuner (L/C Box) and the tuner in my TS-440S, with some success. In none of these instances, however, had I done any real antenna calculations or trimming. Large impedance mismatches were "covered up" by the double-tuner arrangement, and it is questionable how much power was actually being radiated by these "antennas." From my QTH in Hawaii I made contacts to JA, VK, ZL, South America and the continental U.S. mainland during the peak of Solar Cycle 22, when propagation was so good on most bands that one could virtually yell out the window and be heard by DX. Now, with the solar cycle markedly on the decline, contacts while running power (the previous contacts having all been barefoot) were becoming more of a challenge. So what better time to test one's skill/knowledge of antennas? And by what more incongruous vehicle than a beach umbrella?

Photo A. The beach umbrella antenna in action.

The Beach Brawley Boomer

So named by Tony Thomas ZL2ANT ("brawley" is G-land Speak for umbrella), the Boomer measured 82 inches tall and was made of 1-1/4-inch diameter tubing in two sections, which were electrically bonded with self-tapping screws, scrap braid and wire. The umbrella's canopy measured 68 inches in diameter. Rough calculation indicated that the vertical section had about 274 ohms characteristic impedance, and its length translated into a range from 62 electrical degrees on 12 meters to 18 degrees on 40. The canopy, a disguised capacitance hat, seemed to have about 40 pF capacitance, allowing for the open structure of the ribs and the fact that the ends were not electrically hooked together. This capacitance translated into a range from 61 electrical degrees on 12 meters to 27 degrees on the 40 meter band. Surely there was an antenna here, what with the vertical tube and canopy capacitance hat just staring at me.

Further calculation showed that the umbrella should load up on 12 and 17 meters as is, fed at the base, but that some inductance would be required on 20 or 40 meters. As it turned out, base inductance loading was not needed on 12 or 17, and tuning was poor on 10 and 15 meters and marginal on 20 and 40 without a coil. Sixteen turns of #12 AWG copper wire wound on a 2-inch PVC pipe to a length of 3-1/4 inches provided almost 7 μH of inductance which, with that provided by the L/C box, allowed for tuning on 20 and 40 meters with a good match. The coil was attached to the base of the vertical tube, along with an SO239 connector, and a small pigtail of wire was soldered to the braid side of the connector to make provision for alligator-clipping quarter-wave counterpoise wires. After all, this was to be a temporary endeavor, subject to much fiddling . . . a crude blending of theoretical and empirical experimentation.

Although the Boomer was "stuck" on the roof for only one day and night (I didn't want the neighborhood association to condemn me as totally loony), I made contacts on 12, 17, and 40 meters, to ZL (Tony ZL2ANT), California (Fred N6OHH, Ron KD6FZ, Earl W6CPG, Marvin W2AH), Arizona (Link N7OAY), Kwajalein (Val V73DO), and Utah (Paul WA6EW). Also Grant VK2AXB and Cathy VK4FG joined in the fun. Contacts on 20 meters were not even tried due to the QRM, QRN, and QRC (crowding). Signal reports ranged from 4/1-5/1 on 12 meters, to 5/3-5/6 on 40, to 5/5-5/7 on 17. And all of this was during a very noisy period on the bands: 8/24/92 . . . Solar Flux 111, *Boulder A index 40*, K index 2.

Despite the poor band conditions, we had fun. Everyone seemed to enjoy talking to "that guy in Hawaii using a beach umbrella for an antenna."

Matching/Feeding/Counterpoise

The Beach Brawley Boomer was fed with 50-ohm coax through a random wire tuner. SWRs experienced were 1.1:1, 1.1:1, and 1.4:1 on 12, 17, and 40 meters respectively. During the contacts power ranged from about 70 watts to 400 watts. The cloth canopy suffered no damage at 400 watts.

I had only enough scrap wire on hand for one quarter-wave counterpoise on 40 meters, about 33 feet. I initially tried two 13-foot lengths, each a quarter wave, on 17 meters without much effect. Using this wire plus some other odd bits and pieces soldered together gave me one 33-foot length which helped greatly on 7 MHz as well on the higher bands. It's amazing to me that the Boomer worked as well as it did with just one counterpoise. No umbrella trimming was done . . . I still needed it for the back yard!

So what was the point of all of this? To have a bit of fun, of course. The Beach Brawley Boomer doesn't compare with my R5 (12/17 meters) but it did about as well as my 40 meter dipole. Very unscientific "test-

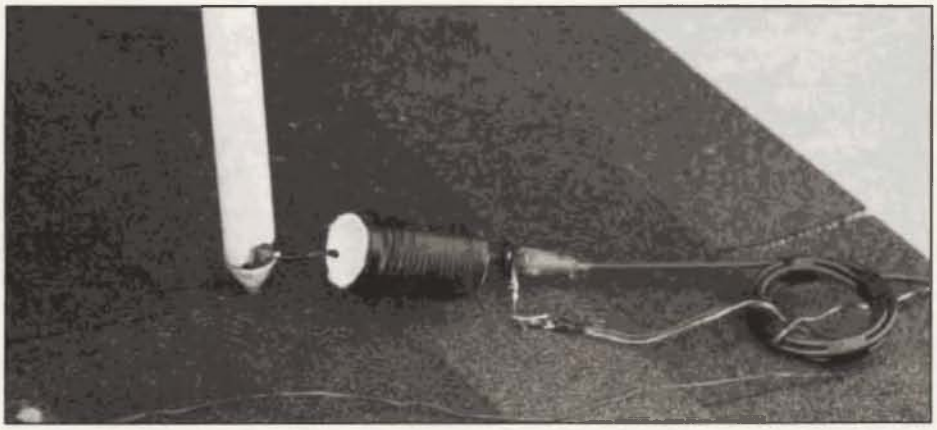


Photo B. The beach umbrella antenna feedpoint.

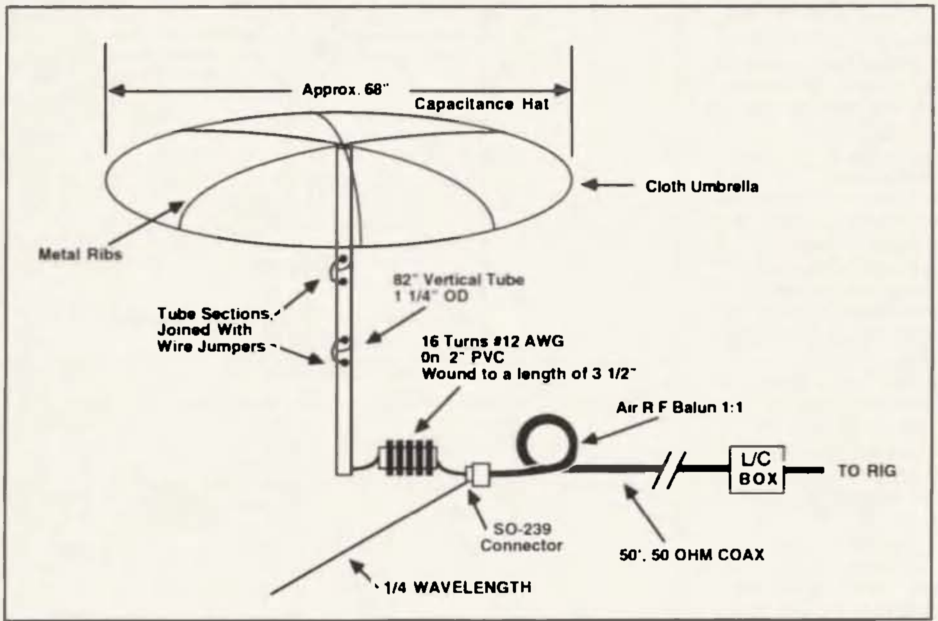


Figure 1. Diagram of the beach umbrella antenna system.

ing" was done, if any was done at all. The point was to have fun and to demonstrate that almost anything can be loaded up and be made to "talk."

Of deeper significance, however, was the demonstration of "Antenna in an Emergency." To me, and I think to many hams, when your antenna is "down" that is indeed an *emergency*. I know of one particular ham, a good friend of mine, who is very dependent on the weather for operation. When the wind blows, down comes the tower, down comes the beam antenna, and my friend goes QRT. But a good stout vertical will stand all but the most ferocious of winds (Hurricane Andrew?) and allow some degree of operation. So, although it would seem that the exercise with the Beach Brawley Boomer was purely for fun, the real ulterior motive behind it all was to show that an emergency antenna, even an umbrella, can allow operation to continue.

It is my opinion (please allow me while I'm on the soapbox) that a vertical of some kind, if only used as an emergency standby antenna, is fundamental, a prerequisite to any ham's family of antennas. Why, even a beach umbrella will do in a downpour. 73

BEACH BRAWLEY BOOMER DATA

Band (meters)	Frequency (MHz)
12	24.985
17	18.113
40	7.163

ELECTRICAL LENGTHS, DEGREES*

Vertical Tube	Canopy Hat	Coil	Total	Approximate Total Wavelength
62	61	15	138	3/8
45	53	17	115	1/3
18	27	42	87	1/4

*Note: For calculations and formulae, see *QST*, September 1978 (Walter Schulz K3OQF), regarding capacitance hat loading; and *The ARRL Compendium Vol. 1* (Bruce Brown W6TWW) regarding the base loading coil design.

Number 12 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099-0099
Falls Church VA 22041

We would like to welcome our newest columnist, Joe Carr K4IPV, to 73. Joe has been a ham since 1959 and is the author of over 80 books, including Secrets of RF Circuit Design *and the* Practical Antenna Handbook. *He has written over 450 articles, mostly about radio and electronics.*

A New *73* Column!

Guess what? I'm back! Readers who remember my long-running column, "Practically Speaking," that appeared in the now defunct *Ham Radio* magazine will, I hope, be pleased to see that my column is now in *73* under a different title. This column will deal with a lot of different topics, but all will have some technical aspect of ham radio as the central theme. Some columns may include a product review or two, while others will be small construction projects.

There will also be a few tutorials on one technical aspect of radio or another, although the general thrust will be practical rather than material laden with math and deep theory. From time to time we will take a look at antennas.

I welcome your suggestions. You can send recommendations for topics, complaints, kudos, brickbats and whatever to me either care of the editor, or directly at P.O. Box 1099, Falls Church VA 22041-0099. Or just come up to me at a hamfest if you see me . . . I'm friendly enough and love to rag-chew. This month, we will take a look at how to use the MAR-x series of silicon monolithic microwave integrated circuit chips (MMIC) available from Mini-Circuits Laboratories, Inc.

The MAR-x Series

The MAR-x series of devices are small ICs that will operate at frequencies from DC to either 1,000 MHz or 2,000 MHz, depending on the type number. The actual type number will be MAR-x, with the "x" replaced by 1, 2, 3, 4, 6, 7, or 6. Table 1 shows the characteristics of MAR-1 through MAR-8, including maximum operating frequency, noise figure and the gain at 500 MHz (gain is slightly higher at 100 MHz, and less at the high end of each device's range).

Figure 1 shows the package of the MAR-x devices. Note that it looks a bit like a small-signal RF or microwave transistor, even though it is an integrated circuit. There are only four leads, labeled 1 through 4: RF INPUT (lead 1), GROUND (lead 2), RF OUTPUT (lead 3) and another GROUND (lead 4). The RF input (lead 1) is marked by two keying devices: a color dot and a beveled tip on the lead. The color of the color dot indicates the type number of the dot (also tabulated in Table 1).

An interesting feature of the MAR-x devices is that their internal circuitry makes both RF input and RF output a good match to 50 ohms. Because of this feature, the MAR-x devices can be used for both tuned and wideband applications, depending on the input and output circuitry selected. For a wideband amplifier, it is only necessary to capacitor-couple the input and output leads directly to the input and output jacks.

Figure 2 shows the basic circuit for the MAR-x devices. The input and output circuits consist of capacitors C1 and C2, respectively. These capacitors can be 0.001 µF disk ceramics in the 80 meter to 6 meter range, but should be chip capacitors if the desired upper frequency band is 2 meters or higher. For amplifiers that operate only from 2 meters and up, use 100 pF chip capacitors.

The DC power to the MAR-x devices is passed to the chip via the RF OUTPUT terminal, lead number 3. The MAR-x devices operate from low voltages. The MAR-x device wants to see +5 volts, while other types demand from +3.5 to 7 volts. In order to operate the MAR-x devices from higher voltage DC power supplies, use a series resistor (R1) to drop some of the voltage. The value of the resistor is determined by the supply voltage (Vdc) and the set current, which is a function of the device type. For the popular MAR-1 device, which operates to 1,000 MHz, the usual current drain is 15 mA, or 0.015 amperes. The value of the resistor (R1) is:

$$R1 = \frac{Vdc - V}{I} \qquad (1)$$

For example, consider a case where the MAR-1 is to operate at 15 mA from a voltage source of +12 volts DC. The resistor should be:

$$R1 = \frac{(12) - (5)\ \text{volts}}{0.015A} \qquad (2)$$

$$R1 = \frac{7V}{0.015A} = 467\ \text{ohms} \qquad (3)$$

Of course, a 467-ohm resistor is a little hard to come by, so use a 470-ohm resistor instead . . . besides, it is likely that a 5% tolerance 470-ohm resistor will have some value closer to 467 ohms anyway.

Sometimes, an optional RF choke (RFC1) is used between the resistor and the MAR-x device. This choke should have a value between 1 µH and 1,000 µH, depending on the desired frequency range. Many people might prefer to use a ferrite bead (F.B.) slipped over the lead of the resistor instead of the RF choke (see inset to Figure 3). These beads are available from Amidon Associates (P.O. Box 956, Torrance CA 90508).

Figure 3 shows a typical layout for a printed circuit board. I built a couple of sample circuits while preparing for this article, not with PCBs but with perforated board and adhesive-backed copper foil (the kind used to make pseudo "printed" circuit boards). In order to make 50-ohm striplines for the input and output lines on G-10 Epoxy/Fiberglas™ board, use a width ("W") of 0.108 inches.

The MAR-x devices are a very handy way to obtain either wideband RF amplifiers or tuned amplifiers. Tuning is accomplished by adding either bandpass filters in the input and output networks, or a single-frequency LC-tuned tank circuit.

The really neat thing about the MAR-x device is its low cost. The price of the MAR-1 (1000 MHz) device is about $1.25 (quantity of 10). Mini-Circuits, Inc. also offers a designer's amplifier kit (product number DAK-2) that offers five of each model, for a total of 35 devices, at $59.95. Plenty of devices for experimenting!

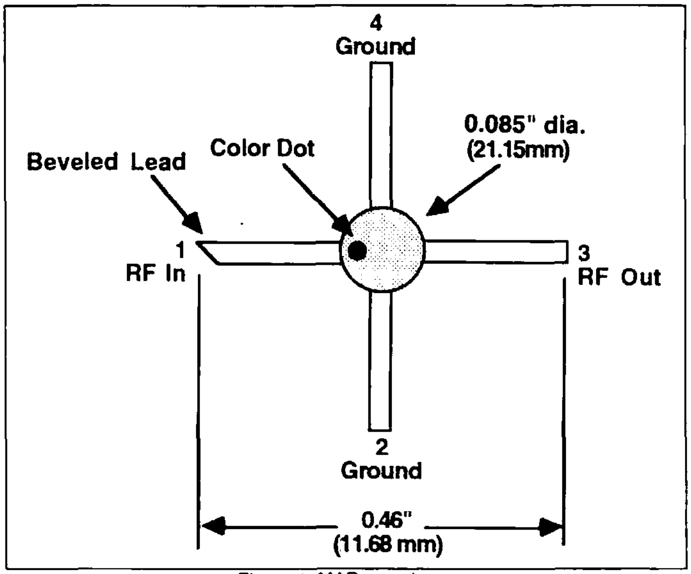


Figure 1. MAR-x package.

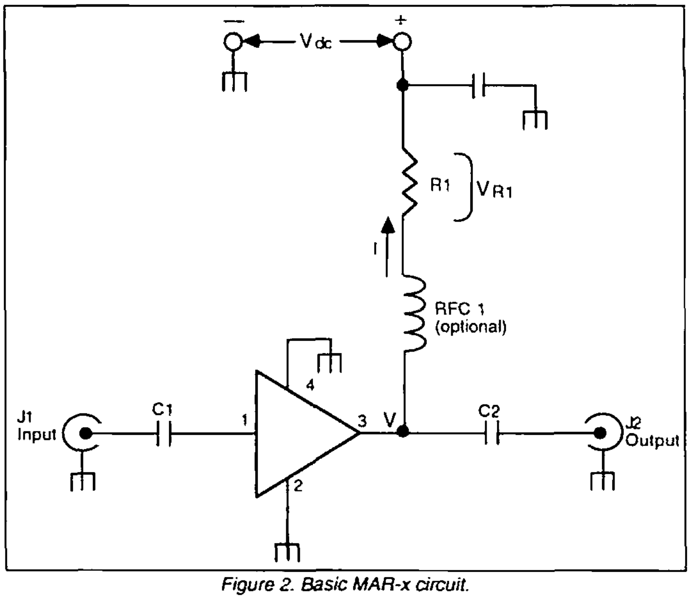


Figure 2. Basic MAR-x circuit.

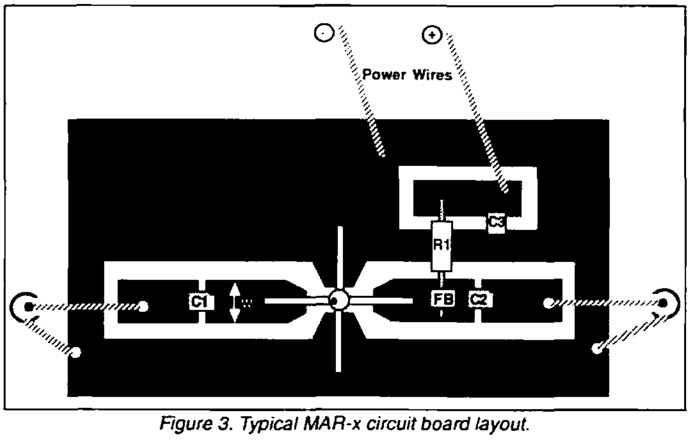


Figure 3. Typical MAR-x circuit board layout.

Table 1. The MAR-x Series.

Type	Color Dot	500 MHz Gain (dB)	Max. Freq.	N.F. (dB)
MAR-1	Brown	17.5	1,000 MHz	5.0
MAR-2	Red	12.8	2,000 MHz	6.5
MAR-3	Orange	12.8	2,000 MHz	6.0
MAR-4	Yellow	8.2	1,000 MHz	7.0
MAR-6	White	19.0	2,000 MHz	2.8
MAR-7	Violet	13.1	2,000 MHz	5.0
MAR-8	Blue	28.0	1,000 MHz	3.5

Number 13 on your Feedback card

73 Review

by Bill Brown WB8ELK

The Tigertronics BP-1 Packet Modem

Just add one computer for instant packet.

Tigertronics, Inc.
400 Daily Lane
P.O. Box 5210
Grants Pass OR 97527
(800) 822-9722
Sales: (503) 474-6700
Tech Support: (503) 474-6702
Fax: (503) 474-6703
Price Class: BP-1 with BayCom vers. 1.4, $49
BayCom vers. 1.5, $20 option
C-64 Adaptor, $20 option

How would you like to get on packet radio for under $50? If you have an IBM compatible computer laying around, you only need to add the BayPac model BP-1 Packet Modem and run a software packet program. It's that easy!

The folks at Tigertronics have designed their BP-1 packet modem to operate with the popular BayCom program (written by DL8MBT and DG3RBU in Germany). Essentially, BayCom (and others such as SofTNC) takes all of the functions of a packet terminal node controller (TNC) and does it in software. You only need an external modem to operate packet with a computer running the BayCom program.

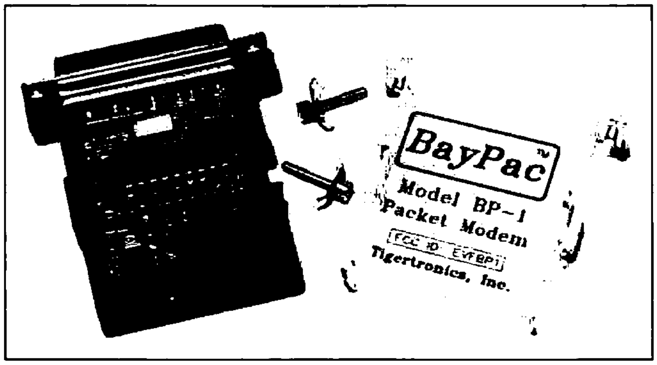


Photo A. The Tigertronics BP-1 Packet Modem fits in a case the size of a DB-25 connector housing.

With the addition of a very small interface between the computer and the real world (your VHF rig), you now have a full-featured packet station.

The BP-1 Packet Modem

The BP-1 modem comes in a case no bigger than a DB-25 connector housing. The top of the case is clear and allows you to see the inner circuitry (a nice touch that is certain to elicit a few admiring comments from your fellow packeteers).

The BP-1 is designed to plug into your computer's serial port. You can use any COM port by changing a configuration file in the BayCom (or SofTNC) program. For those of you with 9-pin serial ports (AT machines or laptops), you will need to use a 25-pin to 9-pin adaptor or cable (available as an option).

Your HT or home station hooks up to the BP-1 via a telephone-style cable with an RJ-11 telephone jack. Since the BP-1 was designed to minimize RF radiation from its circuitry, you can use unshielded telephone line (up to six feet) with no ill effect. This allows you to make up several cables for different radios using inexpensive telephone cables, and to quickly change them via the BP-1 quick-connect socket.

Also, for those of you with Commodore C-64s, the BP-1 modem will work with the DigiCom packet program through the use of a $20 adaptor.

No Batteries!

The BP-1 uses a custom modem IC that draws a fraction of the current of the other popular modem ICs (less than 2 mA). As a result, you can power the BP-1 directly from the voltage present on your computer's serial port. Even laptops with low serial port current handling capabilities provide enough power to operate the BP-1.

Interfacing to Your Rig

The BP-1 manual shows the proper method to hook up the interface cable from the BP-1 to your HT or home rig. Since a number of HTs use a PTT keying resistor on the audio line, the BP-1 includes a built-in keying resistor that you can activate through the use of a plug-in shorting jumper. This eliminates the need to wire up the keying resistor in the wiring harness or jack. Although the 3.0k value works for most HTs, yours may require a higher value. In this case you will have to wire an external resistor in line and leave the jumper shunt unplugged.

The program disk included with the BP-1 has a file called "Hints.doc" which contains pinouts and wiring examples for most popular radios. Tigertronics also has a support line that you can call to get you up and running. It's manned by a live technical staff from 1:00 to 5:00 p.m. Pacific Time. At other times they have an automated tech support line with recorded messages that you can select from a touch-tone menu. These messages contain wiring diagrams and pinouts for most radios and answers to some of the most common questions.

Some folks may be concerned about the use of unshielded telephone cable between the BP-1 and the radio (see Figure 1 for a suggested connection to an HT). The BP-1 was designed to minimize RF interference to your rig from both the modem and your computer (it's even FCC emission-certified). The modem crystal frequency was chosen to put harmonics outside of any packet frequencies. The only problem area is lhe situation where you have your transmit antenna too close to the BP-1 (such as using an HT with its rubber duck antenna). Tigertronics strongly recommends that you use a remote antenna (at least six to 10 feet away from your radio). This will prevent RF from getting into the interface or your computer. In extreme cases running higher power, you may need to use shielded cable for the interface leads (the manual shows a wiring example).

On The Air

There are only two adjustments necessary to set up the BP-1 for your particular radio. First, you may have to adjust the "Level" control for a transmitter deviation of 4 kHz. The Level control is a small pot recessed in the end of the BP-1. The factory level setting should be already be correct for the majority of rigs; I didn't have to adjust it during my tests. Finally, you need to set up your receive volume to a 1-volt p-p output (about two-thirds volume on most rigs).

Of course, the first on-the-air test I performed was to operate the BP-1 packet system with my HT (with rubber duck) operating next to my computer (not recommended). Even with the unshielded phone cable interface, I didn't notice any problems with RF getting into the modem or the computer. However, my computer produces a lot of interference in the 2 meter band so only the strongest local packet stations could get through. I did some tests comparing a shielded interface cable vs. lhe unshielded telephone cable and could detect no noticeable difference in performance.

Next, I tried three different remote antennas: a Pico-J by Antennas West, my Larson quarter-wave mag-mount (sitting on my refrigerator for a ground plane) and my rooftop vertical.

The Pico-J is a J-pole attached to about six feet of miniature coax. Getting the antenna that far from my computer and rig really helped a lot. Only a small amount of computer hash

was detectable and packet operation was possible with all but the weakest stations. My refrigerator-mounted mag-mount (use a good ground plane when using a quarter-wave mag-mount), as well as the rooftop vertical, eliminated virtually all of the hash and I was able to make packet connects with just about any station I could hear.

The BayCom Packet Program

The BP-1 comes with shareware version 1.4 of BayCom. This is a full-featured packet program that offers three different windowed displays on the main screen: the top window is the outgoing keyboard buffer; the middle window shows the current conversation; and the bottom window shows status lines and frame info. BayCom allows you to establish eight different conversations at a time, gives others the ability to use you as a digipeater, and has an excellent help screen function to guide you through all of the different features. You can also easily capture any files to disk.

The BayCom manual comes on disk. When you print it out, make sure you have a lot of paper in your printer as it's a real doozy! Since most people initially find the BayCom manual overwhelming, Tigertronics includes a file called "Commands.doc" on the program disk which contains a summary of all the important BayCom commands, what to do with them and how to get started with your "first connect." The BayCom team has spent a lot of time and effort to make this a versatile program. The updated version 1.5 is now available as a commercial product (also available from Tigertronics).

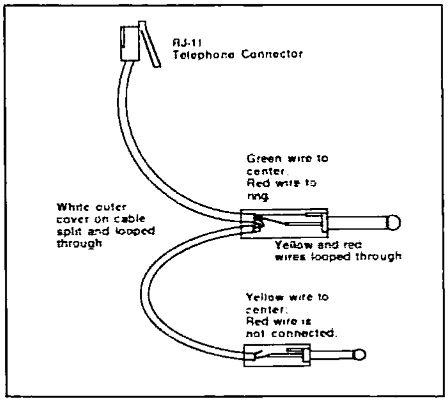


Figure 1. Suggested wiring diagram for a typical HT interface using the telephone-type cable supplied with the BP-1.

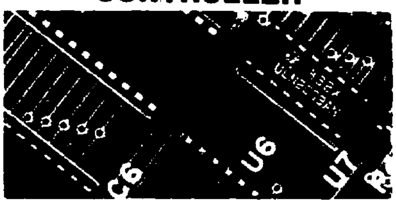
SofTNC

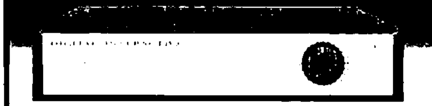
The BP-1 modem is also compatible with another program designed for the BayCom style modem. One such example is SofTNC by j•Com. SofTNC is a streamlined program designed to get you up and running with minimum fuss and bother. It allows one connect at a time and has good text capture and storage capabilities. Although it doesn't have the bells and whistles of the BayCom program, it is very easy to understand and use. Those of you familiar with the popular PMP program (see "Poor Man's Packet," *73 Amateur Radio Today*, August 1991, p. 8) will recognize that SofTNC has the same command structure and configuration parameters. SofTNC was written by Andy Payne N8KEI (the author of "Poor Man's Packet") specifically for j•COM for use with BayCom-style modems.

Conclusions

Operating packet with the Tigertronics BP-1 and either of the software packages was a lot of fun. It was amazing just how well this miniature interface worked. I couldn't tell that there wasn't any TNC in the system at all. I tried the BayCom program on several different types of PC compatibles (and original IBMs) with no problems. The ultimate test was getting the program to work on my speed-demon 4.77 MHz AT&T 6300, although there was some random snow zipping across the menu screen. I've heard that there are some laptops and some 386SX machines that will not work properly with one or both of the programs. Usually, if your computer will not operate with BayCom, the SofTNC program will work (or vice versa). Although rare, I can't rule out the possibility that there may be some machines that won't function with both programs.

I really enjoyed the capabilities of both programs. The combination of BayCom (or SofTNC) with the BP-1 modem gave me a versatile packet station with the ultimate in portability.





RTTY LOOP

Number 14 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

SS-50

It should be snowing now in many parts of the country. Other areas have *their snowbirds arriving. Here in* Baltimore, well, we haven't had a white Christmas in many years. Nonetheless, I do pass along greetings for the season, with Channukah and Christmas wishes to each and every one of you.

Here's a letter from Roy Baumiller, Jr.. WB3HDZ of Everett, Pennsylvania. He relates that it has been a while since he last wrote, dating that back to the time I was rabble-rousing for a 6809 program for RTTY. He also seconds the suggestion that those hams using VIC computers "stay with it" and not immediately jump ship to larger systems.

The most impressive story told in the *letter, though relates to mechanical* teleprinters. It seems that this past year, Roy had an opportunity to attempt to copy the Armed Forces Day RTTY test in an "all computer mode." He describes being helpless, then a voice signal came up on frequency (this is quite common with some of the MARS frequencies). There was no margin for distortion. "If I had had my 390A, Dovetron, and a Model 28RO, I would have had it. But I couldn't use narrow bandwidth with the RTTY program, so on wide I lost signal at each static crash, etc. Disappointed and frustrated to say the least."

I guess that's the same reason I keep *a typewriter in the office*, and why I drop to DOS routines when there are Windows versions of the same program. If it ain't broke, don't fix it!

Roy also says he is looking for anyone who still sells, uses, or services SS-50 computers. As a "diehard 68xx'er on SS-50," Roy is becoming frustrated looking for suppliers. For those of you who have no idea what SS-50 is, early home computers were built on a motherboard/bus design. While the most popular of these was the S-100 bus, around which the popular Altair, Imsai, and other 8080 or Z-80 systems were designed, systems using Motorola architecture, beginning with the 6800 CPU, used a 50-line bus, commonly called the SS-50. Why "SS"? The originator of the system was a company called Southwest Technical Products, Inc., but the first practical accessories were from a company called Smoke Signal Broadcasting. Smoke Signal = SS! Anyway, the SS-50 computers created an active side spur of personal computers. At its peak, we were running a multi-tasking, multi-user operating system on 6809 computers, called "OS9." Hmmm . . . I wonder if that name ever spawned any offspring? Anyway, if any of you out there are still running SS-50 systems (mine is in the *basement gathering* cobwebs), or OS9, or know what happened to SWTPC, SSB, 68 Micro, or others of the time, drop us a note. Both Roy and I are interested to hear the tales.

ARC, ZIP, and Other Oddities

For several months now, I have been offering a collection of programs for IBM compatible programs for RTTY, packet, and other ham functions. I supply these programs in archived form. Apparently, quite a few of you are not familiar with these types of programs, and have expressed this to me in quite a few letters. So, to help explain what I'm talking about, and how to use these and many other programs you might download from a BBS or obtain on a "shareware" disk, I herewith provide the following introduction to archives.

In the dim, dark, past of computer communication, back when we all communicated at 110 baud, or an adventurous few at 300 baud, sending a program might take quite a bit of time. Moreover, if you had a set of programs that worked together—say a program, data file, and documentation file—you might be interested in a way to combine them into one file for transfer.

Many such techniques have been developed over the years. One of the earliest was the "library" concept (denoted by a filename with the extension ".LBR"). Following this lead, all current archiving utilities use the filename extension to indicate the type of archive in use. So, for example, if you had a word processor, called WRDPRC.EXE, and a document file, called WRDPRC.DOC, you might join them together in a library called WRDPRC.LBR.

While the library concept was one of the first, if not the first, practical archivers in use, it has been supplanted by and large by three major, and several minor, protocols. The .ARC extension indicates a file compressed by either the ARC program, produced by Software Engineering Associates, or an older program written by Phil Katz, called PKPAK. Well, PKPAK was originally called PKARC, but SEA, the inventors of the ARC format, objected, and Phil first changed the name of the program, then devised an entirely new scheme, ZIP. Files with the .ZIP extension have been encoded with Phil Katz's PKZIP routine, perhaps the most popular compression and archiving utility in use. Another major player comes from Japan. Originally called LHARC, and now just LHA, files compressed with this powerful program may be identified by a .LHZ extension.

As I indicated, there are some other, less often seen, programs out there as well. A .PAK extension relates to a program of the same name, as do the .ZOO extension and .ARJ extension. Each scheme has its proponents and favorites, and each one may have some advantage, even slightly, over the others.

No matter which routine you are using, decoding the programs is pretty much the same thing. You should type the name of the decoding program, any required switches, and the filename, without the extension, of the archive to be decoded. So, if you wanted to dearchive a file (let's call it RTTY.ARC, or RTTY.ZIP, or RTTY.LHZ) for the three major programs, you would type the following command (shown in bold):

For RTTY.ARC use **ARCE RTTY**
or **PKUNPAK RTTY**
For RTTY.ZIP use **PKUNZIP RTTY**
For RTTY.LHZ use **LHA E RTTY**

Now, command-line switches and the like can be daunting to anyone. Therefore, there are programs that isolate you from the program itself and take care of all the compression for you! One of the most useful of these is called SHEZ. Once configured, a procedure performed by answering questions the program asks at first startup, SHEZ will dearchive any of these programs. It does this in a <<shudder>> user-friendly, point and shoot environment.

One last hitch in all of this. Sometimes archived programs are distributed in "self-extracting," also called SFX, format. Here, a small integral decoder has been added to the archive, and the file extension has been changed from ARC, ZIP, LHA, or the like, to EXE so that a big archive called RTTY.ZIP can be transformed into an SFX archive called RTTY.EXE. Typing RTTY will then lead to automatic extraction of the archive, no decoder needed. Yes, SHEZ can handle those, too.

Hopefully, this *will* give *you the* base information to deal with the variety of archived programs out there. To facilitate this, I will go ahead and put together a collection of these archiving programs for you and make them available per the usual offer. Simply mail me a high density disk, either 5" 1.2 Mb or 3.5" 1.4 Mb, a self-addressed, stamped disk mailer for its return, and two dollars in US funds, and I'll send you the archiving utilities. Be sure to specify now, when you mail me a disk, whether you want the latest RTTY programs or archive utilities, otherwise who knows what you'll get back!

In the meantime, I look forward to your questions and comments. Please send them via US Mail to the above address; CompuServe at ppn 75036,2501; Delphi at username MarcWA3AJR; or America Online at screen name MarcWA3AJR. I read them all, look forward to them all, and who knows—you might just find your name here in "RTTY Loop."

ATV

Number 15 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

ATV Repeaters

A lot ol folks ask me for info aboul putting up an ATV repeater system. As a result, I'll be periodically featuring different repeater systems and how they are put together.

Recently I dropped in on an ATV repeater system that we can actually work from the *73* hamshack, even though it is about 60 miles away (mountains are a great place for a repeater lower).

The KC1RH ATV Repeater

Located atop a 1230-foot foothill near Leyden, Massachusetts, this repeater covers the tri-slate area of western Massachusetts, southeastern Vermont and soulhwestern New Hampshire. With a good view of the Connecticut River Valley, the KC1RH machine has been received as far south as Connecticut.

Ed Skutnik KC1RH installed the repeater at the site of his commercial FM radio station (WRSI—95.3 MHz). The repeater has an input on 434.0 MHz wilh two outputs on 421.25 and 1241 MHz. The receive/transmit sections are all PC Electronics repeater modules (ATVR-4, RTX-70 and RTX-23). He has a pair of four-bay Sinclair SRL 310C-4 vertically polarized antennas at the 170-foot level of the tower (receive) and 120 feet (421.25 MHz transmit). In addition, a Diamond BDY-1218 omni-directional vertical was installed at 145 feet for the 1241 MHz output. With the exception ol the 1241 MHz transmitter, all coax runs are Cablewave 7/8" hardline (see the repeater block diagram in Figure 1). Input filtering is performed using an International Crystal VSB filter (model FL407) and output filtering is done with Spectrum International VSB fillers for both 421.25 (PSF-421-ATV) and 1241 (PSF-1241-ATV) MHz. The output power on 421.25 MHz is 100 watts (using the repeater version of the Mirage D-100 amplifier); only 1.5 watts are available on 1241 MHz.

When video sync is detected by the PC Electronics VOR-2 (video operated relay), DC power is applied through a bank of relays to the transmit modules. Through a touch-tone decoder (Hamtronics TD-2) and relay board, different transmitters and video feeds can be selected (see Figure 2). The delault setting *turns* both the 421.25 and 1241 MHz transmitters on whenever a received video signal trips the VOR. In the future, Ed plans lo install a second receive frequency to link up with the W1HGJ ATV repeater on Soapstone Mountain, Connecticut (426.25 MHz output).

Local Activity

The WB1GUY 2m repeater on 146.985 (-600) is used as the local ATV talk frequency. A PL tone (4Z) is sometimes required when interference is severe from distant repeaters. Since the 2m repeater is co-located wilh the ATV repeater, a touch-

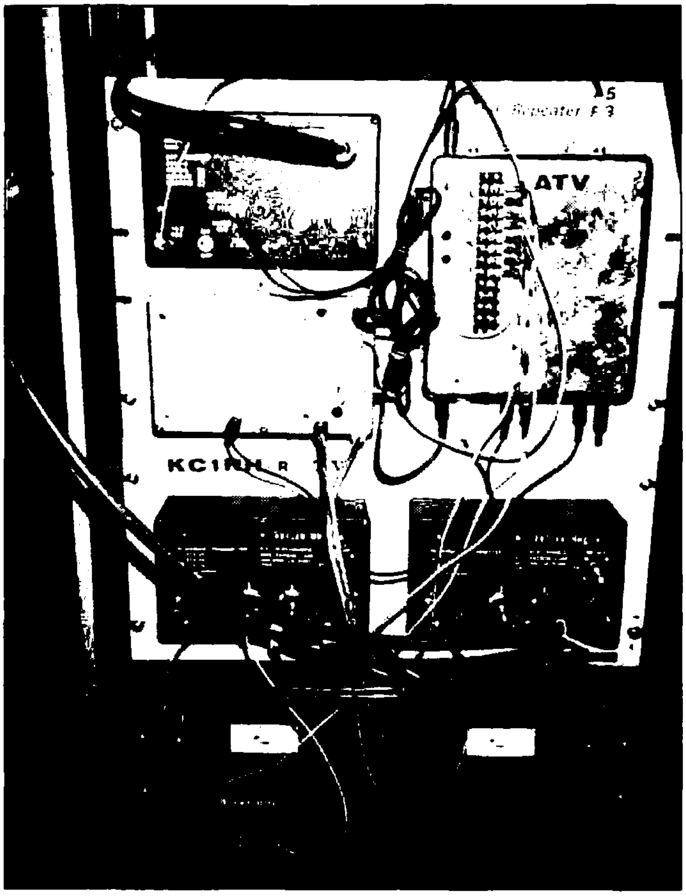


Photo B. Close-up view of the neatly arranged ATV repeater modules. Left side (top to bottom): 434 MHz receive, video operated relay/video ID and 421.25 MHz transmit. Right side (top to bottom): touch-tone controller/relay control box and 1241 MHz transmit. A 50-amp Astron power supply and the Mirage D-100TVNR 100-watt repeater amplifier are shown on the bottom of the rack.

Photo A. Ed Skutnik KC1RH demonstrates the operation of his ATV repeater located on a 1230-foot hill near Leyden, Massachusetts. The repeater covers the tri-state areas of western Massachusetts (the Connecticut River Valley), southeastern Vermont and southwestern New Hampshire.

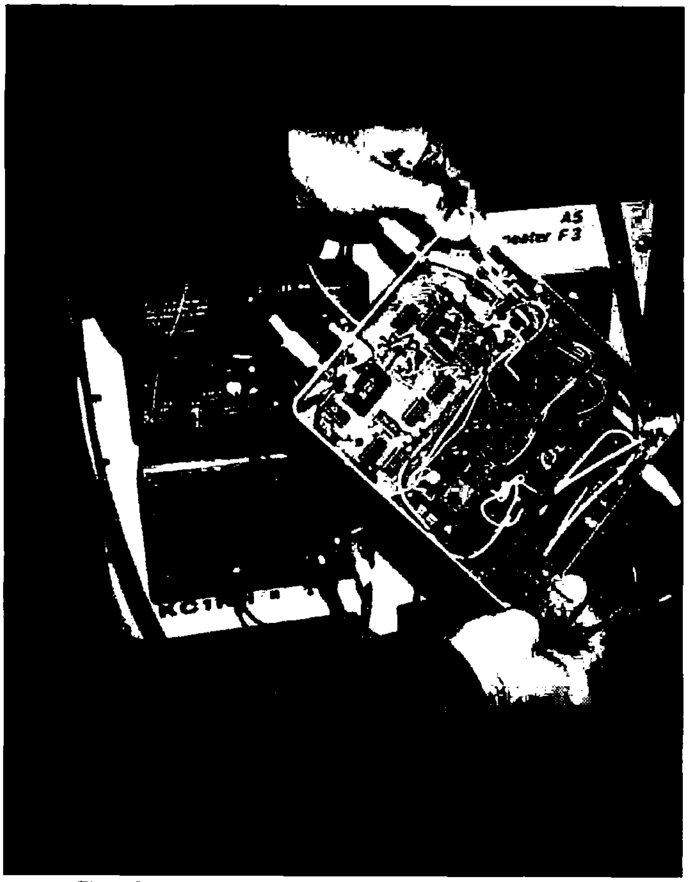


Photo C. Internal view of the touch-tone controller and relay box.

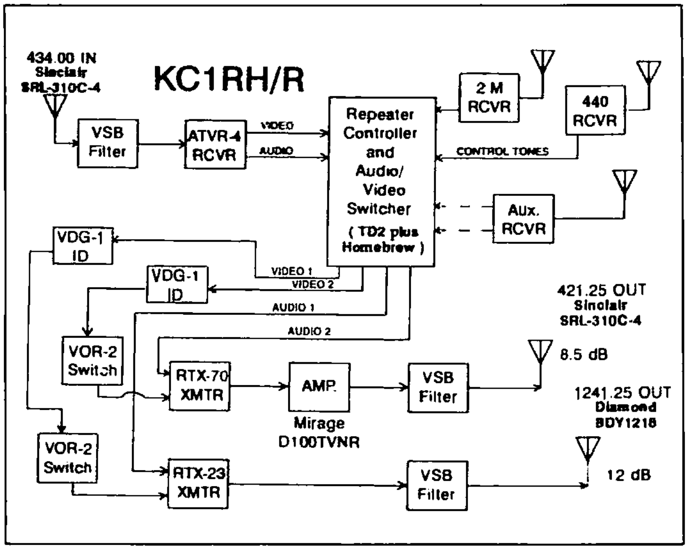


Figure 1. Block diagram of the KC1RH ATV repeater.

lone command can actually link the audio from the 2m repeater through to the ATV subcarrier. Usually a call for ATV activity will net you one of the local ATV operators.

Some of locally active ATVers are Bill Boutwell N1EWK and Perry Cole N1EWL in Greenfield, Massachusetts; Ken Heile W1GZT in Guilford, Vermont; and, of course, Ed Skutnik KC1RH in Sunderland, Massachusetts. If you'd like more information about the KC1RH repeater or activity in the area, feel free to contact Ed Skutnik KC1RH, 58 Reservation Rd., Sunderland MA 01375. Please enclose an SASE for a reply.

Let's Hear From YOU!

I'd like to hear from some of the ATV repeater groups out there. Send me some photos, a block diagram of your system and some info about your group's activities and I'll be happy to share this with *73* readers. Let me know if you've come up with a circuit or a technique to solve a nagging repeater problem.

If your ATV group is involved in an event, emergency or some unique activity, send in a writeup and photos for possible use in a future column. Also, feel free to share any circuits or antennas you've designed or modified that you feel are particularly useful for ATV.

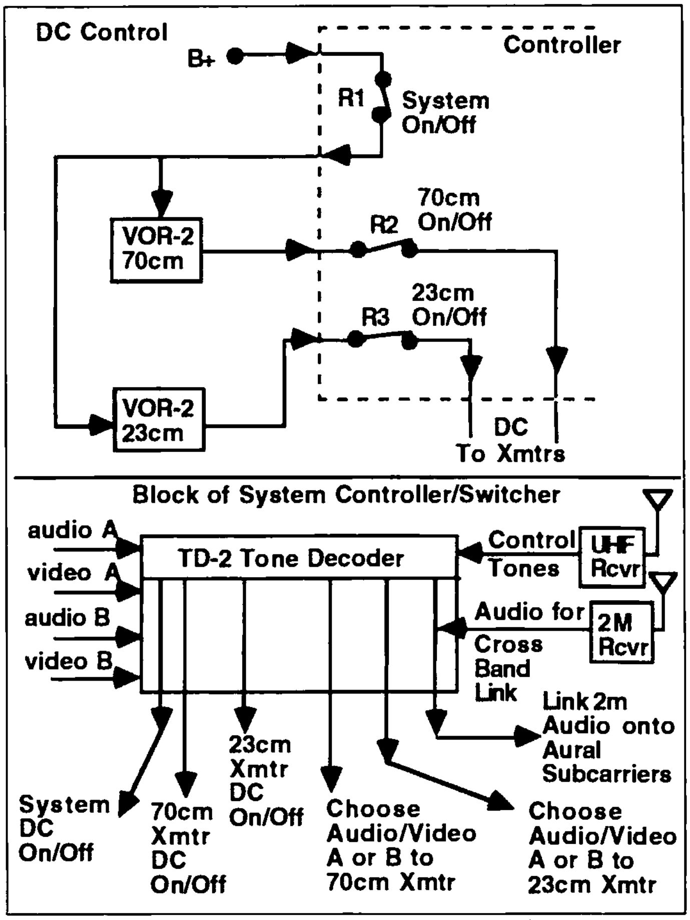
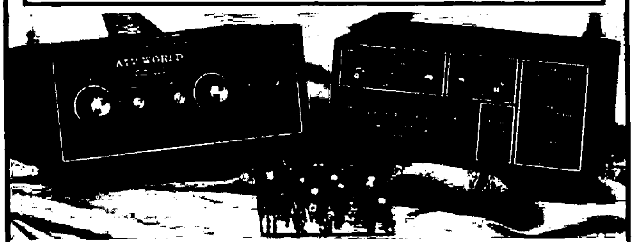


Figure 2. Detail of the touch-tone decoder/relay switchbox.



Number 17 on your Feedback card

An Expanded-Scale Voltmeter

For accurate battery monitoring.

William Call KJ4W

Like many amateurs, I use a 12-volt deep-discharge lead-acid storage battery to power my base station radio equipment. This method has the advantage of providing emergency operation in case of a power failure without having to connect and start a generator immediately, and without having to reset computer-based equipment. It also partially isolates the battery-powered equipment from the power line, reducing the chances of damage during thunderstorms or from other line transients. Battery operation allows the use of a comparatively low-amperage 12-volt power supply or battery charger. High current demands during transmit can be supplied by the battery, which is then gradually recharged during receiving periods. The battery can be constantly recharged using a floating-type power supply, or a higher-current charger can be manually or automatically switched in and out. (An automatic charging controller was described in *73 Amateur Radio Today*, May 1992, by WBØTCZ.)

It is desirable to constantly monitor the condition of a storage battery, i.e. its terminal voltage, when it is used this way, to make sure that the battery is not overcharged or too deeply discharged. It is difficult to use a standard voltmeter with a moving pointer for this task because the useful voltage range becomes compressed into a small portion of the meter's scale, making reading the meter difficult. For example, if a 0- to 15-volt meter is used, the useful portion is from about 10 or 11 to 15 volts; the bottom two-thirds of the meter's range is not used (it would damage a lead-acid battery to discharge it below 10 volts, besides the fact that little useful power would be left). Trying to distinguish precise values in that useful upper third of the scale is difficult. One solution to this situation is to use a digital voltmeter, but even though these are dropping in price they are still fairly expensive, particularly if there is a mostly-junk-box solution available. Indeed there is—a standard analog voltmeter can be converted to an "expanded-scale" meter using the methods outlined in this article.

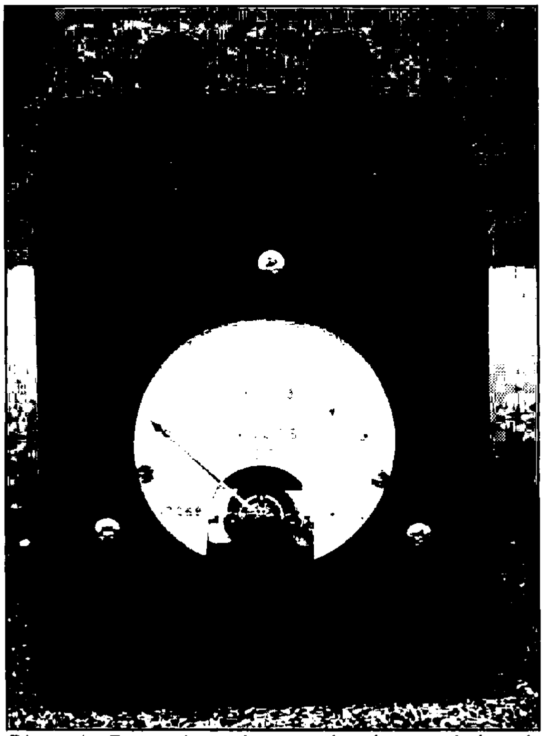


Photo A. Front view of a completed expanded-scale voltmeter, mounted in a metal case. The original 0-5 volt DC meter was modified by inking a "1" before each digit.

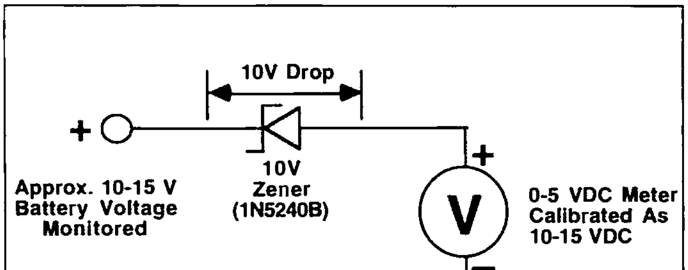


Figure 1. A simple expanded-scale voltmeter.

Converting a Standard Analog Meter

An established way of making an expanded-scale voltmeter is to place a zener diode in series with a voltmeter of smaller range. For example, see Figure 1: A 1N5240B 10-volt zener is placed in series with a 5-volt full-scale voltmeter. The meter will not respond at all until the input voltage reaches at least 10 volts and the zener starts conducting, so the left-hand end of the meter's scale represents 10 volts or below. Any input voltage above 10 produces a proportional increase in meter reading; full scale deflection occurs with 15 volts input, which produces 5 volts across the voltmeter. This is a particularly easy conversion to make: The meter can be opened up and the scale easily modified by placing a "1" before each digit of the 0-to-5 scale, thus relabeling the scale 10 to 15 volts, with no other meter modifications needed.

Though apparently easy to accomplish, this method is disappointingly inaccurate. The weak point is the drop across the zener: it won't be a constant 10 volts, or probably 10 volts at any time. Since most voltmeters are high-resistance by design, the zener current will be much lower than its "test current," which is the point where its voltage drop should be equal to 10. In this example, for the 1k ohm/V meter used, the meter's internal resistance will be its full-scale rating of 5V times 1k ohm per volt, or 5k ohm; or, 1 mA full-scale current. The maximum zener current will be this 1 mA, far below the 1N5240B's test current of 20 mA, and of course the current varies by a large factor over the meter's range. Therefore, the zener voltage will probably be below 10, and will vary some. In addition to these problems, the zener has a tolerance, or stated initial accuracy: The 1N5240B is rated as 5%, or plus or minus 0.5V, from 10V. Most other 10V zener part numbers have even worse accuracy, perhaps 10 or 20 percent.

Testing

To determine how well, or how poorly, the simple expanded-scale meter worked, I selected three new 1N5240B zeners at random and breadboarded the circuit and checked the zener drop and meter readings with a good-quality digital multimeter (the 5-volt meter was first checked and found to be quite accurate). Over the meter's range, the actual zener voltages varied only by 10 mV on the best zener, by 40 mV on another, but by 120 mV on the worst. However, all zener drops were well below 10 volts, with an average of 9.46 volts at mid-scale. This would produce an average error of over half a volt. The worst zener's drop was 9.34 volts, for a mid-scale error of 0.66 volts. There's no easy way to reduce the error because a zener isn't adjustable. The scale could be painstakingly recalibrated using the DMM, but that's no fun, nor would it be attractive.

To improve accuracy and provide for easy, precise adjustment, I developed the circuit shown in Figure 2. Two inexpensive three-terminal IC voltage regulators are used, provid-

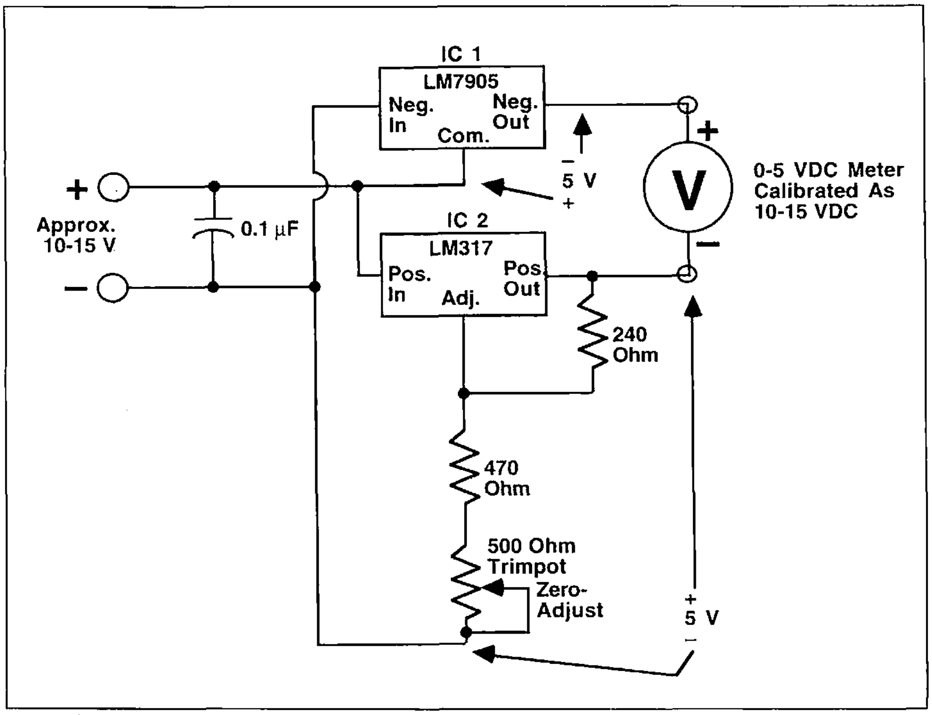


Figure 2. A more accurate expanded-scale voltmeter using voltage regulator ICs.

ing accurate scale expansion and a trimpot for calibration. The "trick" in this circuit is the unusual way IC1 is used: This is a negative-supply regulator, used in an inverted fashion. Its output voltage is negative 5 volts with respect to its common reference, which is connected to the positive input voltage, while its negative input is connected to the negative side of the input voltage. The upshot of this is that IC1's output with respect to circuit common (the negative input voltage) is always 5 volts below the positive input. In other words, as the input varies from +10 to +15VDC, IC1's output varies from +5 to +10 VDC with respect to circuit common. IC2 provides a constant +5 VDC with respect to circuit common; the voltmeter is connected between the regulator outputs, so it "sees" 0 to 5 volts as the input varies from 10 to 15 volts. Therefore, the expanded-scale meter results.

It is tempting to consider eliminating IC2 and changing IC1 to a 7910, producing a 10-volt drop directly. The problem is that IC1, like many regulators, requires a minimum of 1.7V more input than output, so then the meter wouldn't be accurate below 11.7 volts input. IC2 provides an inexpensive reference at +5V to solve the problem, with the additional 5-volt offset of IC1 adding up to the 10V drop needed. Since both ICs are operating as 5-volt regulators, the accuracy is fine to well below 10 volts input.

IC2 is shown as an adjustable regulator, rather than fixed, to allow precise trimming at the zero, or 10-volt, end of the meter scale. The data book says that a minimum load current for a LM317 of 3.5 mA typically is required to maintain accuracy; the meter will usually draw less than this. However, I experienced no problems. A load resistor could be added if needed.

IC1 could be changed to an LM337 negative-voltage variable regulator, if desired, to provide a full-scale trim as well; or the meter's dropping resistance could be varied to accomplish calibration at full-scale. Using a

partly-variable meter dropping resistance to provide full-scale trim is discussed in the section on selecting meters. In the example pictured, the 5-volt meter's accuracy was so good that full-scale trimming was unnecessary. Measured error was less than one minor division (0.1V) anywhere in the meter's range.

Since the meter current is low, the regulator ICs can be either the low-current types or the more common TO-220 package types; no heat sinks are needed. Since any of several regulator packages might be chosen, a pictorial wiring diagram has not been shown. Point-to-point wiring on a perf-board is very practical; just make sure you have the proper pin configuration for your regulator packages, and follow the wiring shown in Figure 2. Photo B shows a completed meter, mounted in a cabinet, with the circuit of Figure 2 mounted on a perf-board attached to the meter terminals. This unit was built using one low-power (TO-92) package and one TO-220 package (what I had in the parts drawer). The zero-adjust pot is visible on the lower left.

The front view, Photo A, shows the slightly modified scale to the original 5-volt meter (the hand-inked "1's" were added before the original numbers), as discussed earlier. Though not shown in the picture, an inline fuse (1/2 amp was used) is in the circuit wiring between the battery and the meter. Always provide a fuse in any circuit attached to a storage battery; if anything shorts and you don't have one, that battery's high current capability will get you in serious trouble very quickly! The meter can be left on continuously; its current consumption is about 7 mA using a 1 mA meter movement.

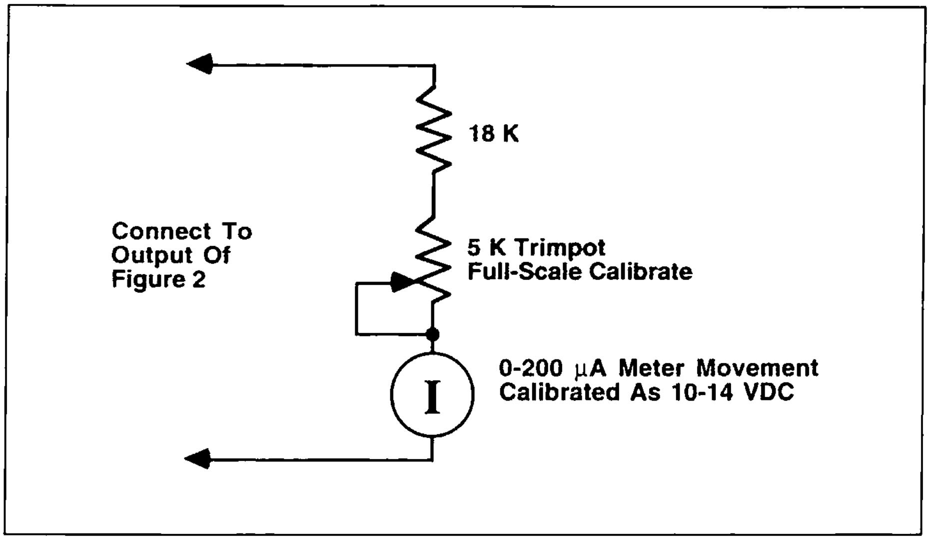


Figure 3. Using a basic 200 microamp meter movement as a 4-volt voltmeter.

Photo C shows another unit that was built with an ammeter included for monitoring either charging current or load current, as desired. Again, note that a fuse is installed.

Finding and Choosing a Meter

Finding a suitable meter shouldn't be hard or expensive. If the junk box doesn't yield a good candidate, a hamfest flea market surely will. Again, the easiest approach is to use a 0-to 5-volt DC voltmeter, as has been discussed. If you can't find one one of those, often you can modify another meter. For example, what if you have a 0-150 VDC meter (see Photo D). Useless, right? Nope; carefully take it apart and look for the series dropping resistor. Short it out and it is back to the basic milliamp or microamp meter movement. Then replace it with a new dropping resistor of proper size for 5-volt sensitivity (outside the meter, probably,

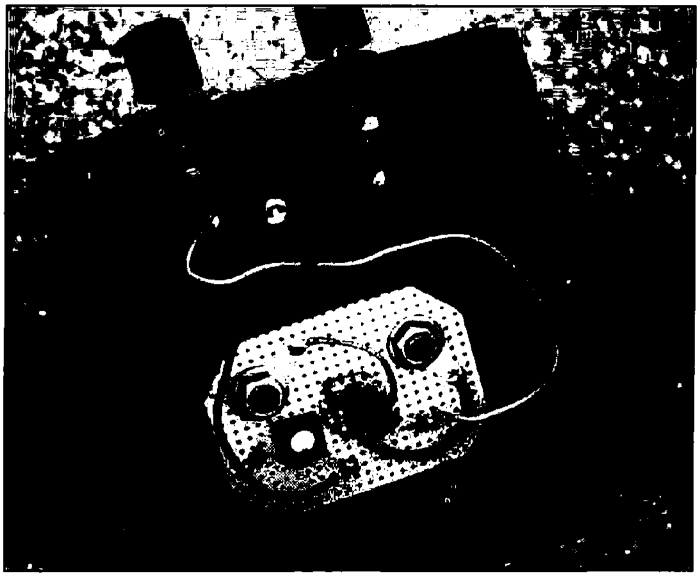


Photo B. Rear view of a completed expanded-scale voltmeter. The circuit of Figure 2 is mounted on a perf-board which is attached to the meter terminals.

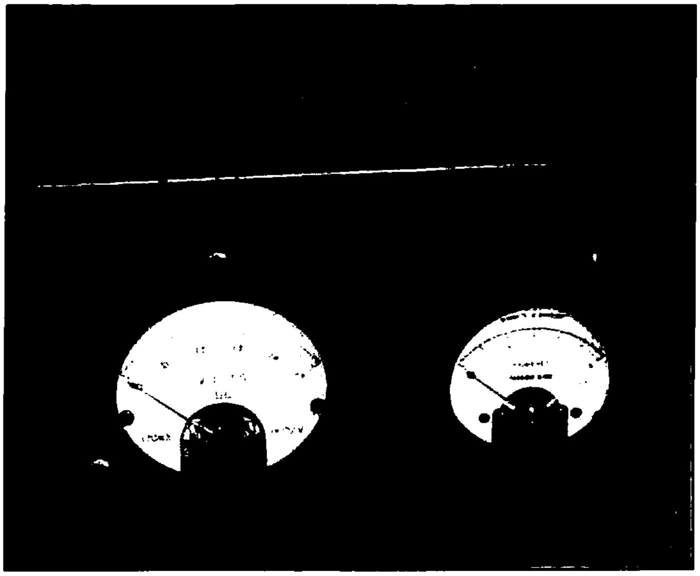


Photo C. Another example of an expanded-scale voltmeter. This unit includes a series ammeter to monitor charging current.

where it can be conveniently mounted on the perf-board). Often, either the meter's current sensitivity or its ohms-per-volt rating is stated in a lower corner of the meter scale; if not, calculate meter full-scale current sensitivity from full-scale voltage rating divided by series resistance. In a few cases the original resistor may be mounted outside the meter, on a board on its terminals; in some cases the resistor might be inside the meter but made harder to identify and access.

Keep in mind that the meter's scale will have to be renumbered; ideally, look for a meter with five major scale segments so that the 1-volt divisions will fall in place. Watch out for sealed meters that can't be opened, for non-linear-scale meters, or for AC meters. These are much harder, if not impossible, to modify. Look for meters that have scale divisions that would ideally divide each volt-spread into tenths.

A basic milliamp or microamp meter movement can also be used; a series resistor doesn't have to be removed in this case. Use a movement of not more than a few milliamps, though, or it will be a power-waster, and the dropping resistor may have to be high-power,

too. For example, suppose you have a 200-microamp meter with only four scale segments. It could be modified to a 4-volt full-scale voltmeter with a series resistance of 20k ohm (series resistance is approximately the full-scale meter voltage desired divided by full-scale current sensitivity). Using the circuit shown in Figure 2, an expanded-scale display of 10 to 14 volts would result. If an 11- to 15-volt range is preferred, IC1 could be changed to a 7906, or IC2 readjusted for a 6-volt drop. The original scale divisions would be fine for the 4-volt range, and the original numbers and microamp label could be covered with white paint or gummed labels and the meter face then relabeled. Full-scale trim can be provided by making about 10 to 20 percent of the total dropping resistance variable with a trimpot; Figure 3 shows a possible meter circuit. If a high-voltage voltmeter is being modified to 4 or 5 volts full-scale, these same considerations apply, once the basic full-scale current sensitivity is found.

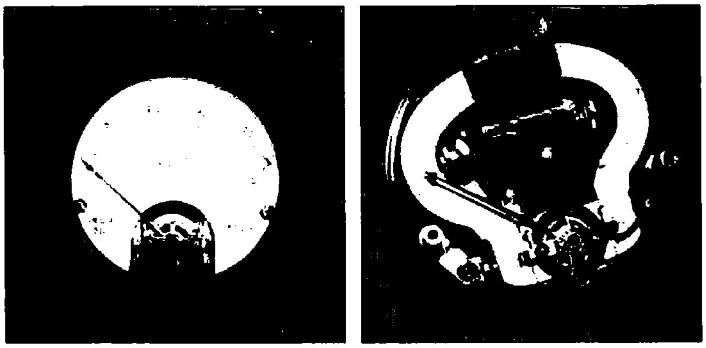
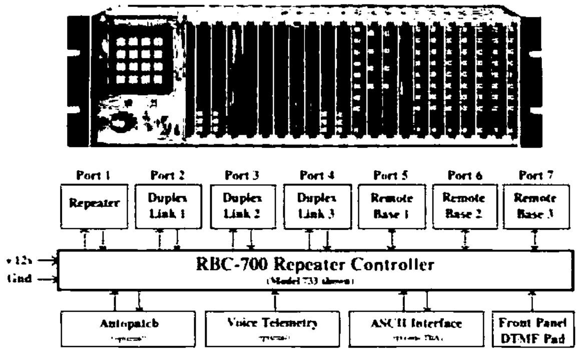


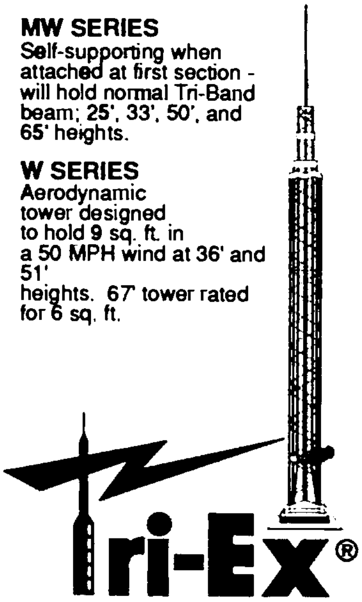
Photo D. Left: This high-voltage DC voltmeter can be modified for low-voltage expanded-scale use. Right: Internal view of the high-voltage meter. The dropping resistor is the large cylinder located in the middle of the horsehoe magnet. This resistor can be replaced with the proper value for low voltage use (see text).

The Voltmeter in Use

Once the expanded-scale voltmeter is built, what should be observed? For manual recharging when the battery is low, the expanded-scale voltmeter shows precisely when to begin recharging. With either an automatic charging system like WBØTCZ's, or with a float-charger, the expanded-scale voltmeter allows constant monitoring to assure that all is well. The terminal voltage of a fully-charged lead-acid storage battery in a constant state, being float-charged with a recharge current barely more than load current to allow for slight trickle charge, should be in the range of 13 to 13.8 volts, depending on temperature, battery design, age, etc. A battery hydrometer can be used to determine full charge, then the voltage checked and the float-charger set; my unit worked out at 13.3V. Under high-current recharge from a partly discharged state, terminal voltage can safely be higher, perhaps 14 to 14.4 volts or so for a few minutes to a few hours. During a deep discharge, the battery terminal voltage quickly drops to about 12.6 and then gradually decreases from there; recharging should begin, or operation ceased, if the terminal voltage drops below 10.5 to 11 volts. Readings outside these ranges indicate a problem that must be investigated.

When using a storage-battery setup, remember to take sensible precautions for ventilation and protection against acid spills, and use fuses and other precautions against short circuits. The water level should be periodically checked and adjusted as needed; float-charging causes a gradual loss of water, and if the lead plates become exposed to air the battery's lifetime will be shortened. The deep-discharge marine-type batteries are far more suitable for this service than are automobile batteries, and are worth the higher cost. Use of the expanded-scale meter, as discussed in this article, will help to maximize the lifetime of this expensive investment.



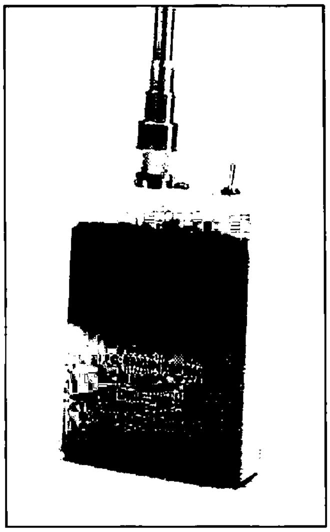


Number 18 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

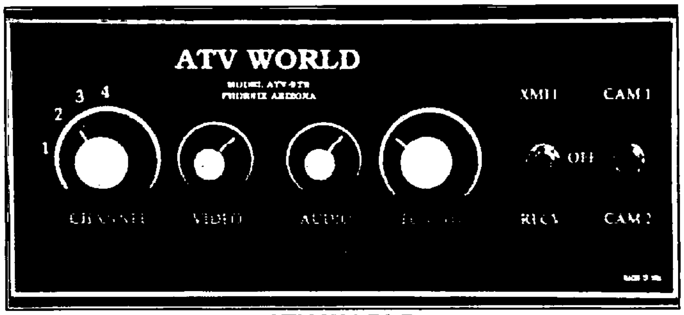
I C ENGINEERING



No more guessing about antenna performance comparisons! The new "DIGI-FIELD" from I C Engineering has an extraordinary frequency response. DIGI-FIELD can be used as a sniffer for 60-cycle noise sources, as well as an intensity detector of microwave oven leakage. It has a 3-1/2-digit LCD display with a low battery indicator and uses a standard 9V battery (future models will have a backlighted display). Its clear visual reading lets you make your own calibration for radiation gain or loss, antenna patterns, polarization, etc. It is designed to be used with its own telescopic antenna or an external antenna with a PL-259 connector.

DIGI-FIELD is $79.95. For more information, contact *I C Engineering, 16350 Ventura Blvd., Suite 125, Encino CA 91436; (818) 345-1692, (800) 343-5358, Fax: (818) 905-3374.* Or circle Reader Service No. 203.

ATV WORLD



ATV World has announced a new line of amateur television equipment. The flagship of their new offering is a unique dual-receiver ATV transceiver. This unit transmits in the 420 to 450 MHz band, and receives in the 1.2 GHz and 420 MHz bands. It includes four-channel transmit, video monitor of the detected RF, built-in transmit/receive change over relay, a dual-gate GaAsFET front end in the 420 to 450 MHz downconverter, 4.5 MHz audio subcarrier on transmit, power and TX indicators, and dual camera inputs. A spare set of audio/video RCA-type jacks are provided on the rear panel. The cabinet is manufactured of 0.60" heavy-gauge aluminum, silk-screened with a black matte-finish cover. Another unique feature is a choice of red or gray front and rear panel color.

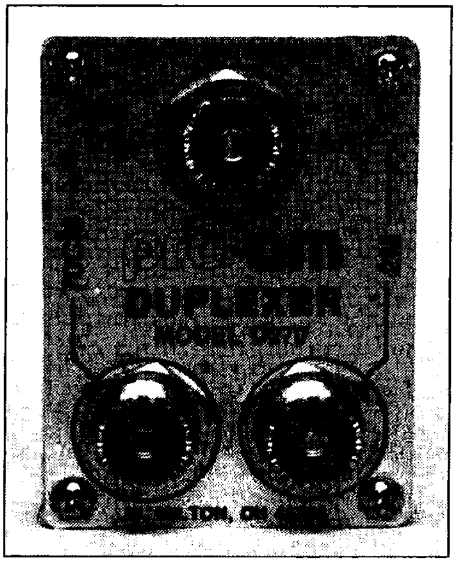
The single-band transceiver can be ordered with the 450 MHz downconverter or with the 1.2 GHz downconverter installed. The single band unit may at a later time be upgraded to a dual-receive system with an upgrade kit. For prices and more information, contact *ATV World, 3713 W. Charleston Ave., Glendale AZ 85308; Technical Info: (602) 978-4348, Orders: (800) 424-2688.* Or circle Reader Service No. 201.

ENTERPRISE RADIO APPLICATIONS

The MK2 Microreader from Enterprise Radio Applications is a self-contained system for the reception and display of CW, RTTY, AMTOR, SITOR and NAVTEX on the HF bands. With the Microreader there is no need for computers, tapes or special leads associated with other systems. Just plug the Microreader into the headphone or speaker socket of your receiving equipment and you are ready to go. The Microreader was designed primarily to receive hand-set Morse; its ability to copy poorly-sent Morse under noisy band conditions is unique. It incorporates extensive filtering, carefully engineered to provide the right amount of processing for these real-life conditions. Decoding automated signals such as RTTY is easy in comparison.

The forward error correcting inherent in the SITOR and NAVTEX modes gives excellent performance, even under poor band conditions. Fully automatic detection, polarity sensing and lock-on makes operation on this mode simple.

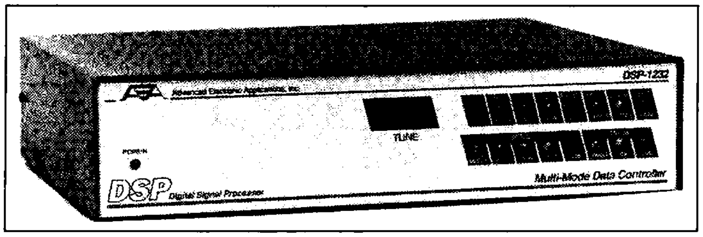
The MK2 Microreader has been designed to work with almost any receiver, and also has an RS232 output port that allows decoded text to be sent to compatible printers, terminals or computers. Plus, it has a built-in Morse tutor. For the price and more information, contact *Enterprise Radio Applications, Unit 5, Clarendon Court, Winwick Court, Winwick Quay, Warrington WA2 8QP, England; Telephone: (0925) 573118, Fax: (0925) 231671.* Or circle Reader Service No. 202.



PRO•AM/VALOR

PRO•AM, a division of Valor Enterprises, has announced the new D270 duplexer for 2 meters and 70cm. This versatile item is used to connect a modern VHF/UHF dual-band antenna with a single feedline to separate 2m and 70cm transceivers or a dual-band transceiver without a built-in duplexer. It can also be used in reverse for connecting separate antennas to a 2m/70cm dual-band transceiver with only one RF output socket. The D270 is perfect for cross-band repeaters and/or remote base links, or it can be combined with a single 2m/70cm antenna to produce a dual-band mobile setup. It can also be used in the home station to connect separate 2m/70cm antennas to a dual-band transceiver or to connect a dual-band antenna to monoband 2m/70cm transceivers.

The suggested retail price for the D270 is $45.90, and it comes with a one-year warranty. For more information, contact *PRO•AM (a division of Valor Enterprises), 185 West Hamilton St., West Milton OH 45383; (513) 698-4194, (800) 543-2197, Fax: (513) 698-7273.* Or circle Reader Service No. 205.



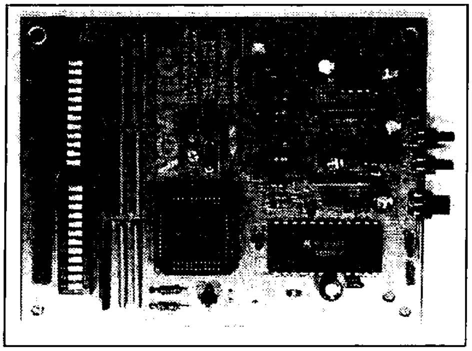
AEA

The DSP-1232 multimode data controller featuring digital signal processing is now available from AEA. A single-port version of the the DSP-2232, this controller features packet, AMTOR, Baudot, ASCII, Morse code, NAVTEX, WEFAX and more. It has all satellite digital modes, 9600 bps K9NG/G3RUH, 2400 bps, automatic identification of most types of digital signals, software DSP modems (future upgrades will be installed on EPROM chips) and software-switchable port selection. New modems can be uploaded into RAM from disk or telephone BBS. It also offers a complete 18K byte personal mailbox. This new controller eliminates the need for external modems for satellite work or high speed data.

The suggested list price is $799. For a product data sheet and a list of authorized dealers, contact *Advanced Electronic Applications, Inc., P.O. Box C2160, 2006 196th St. SW, Lynwood WA 98036; (206) 774-5554, (800) 432-8873.* Or circle Reader Service No. 204.

NOVATECH INSTRUMENTS

Novatech Instruments is now offering the DDS-3, a direct digital synthesizer kit that can be used to output signals up to 12 MHz with excellent spectral purity. The DDS-3 can be programmed to output sine and TTL/CMOS signals from 2 Hz to 12 MHz in 2 Hz steps. The output frequency is determined by setting a 23-bit binary word using either a DIP switch or a parallel ribbon cable input. The output amplitude is 1.4 Vpp into an open circuit. The user can obtain fast switching of the output frequencies since the transition time for changing frequencies is less than 250 ns. Spectral purity is better than -90 dBc phase noise at 1 kHz offset, -45 dBc spurious and -40 dBc harmonic. Stability is better than 10 ppm.



The DDS-3 is priced at $119.95 plus $5 S & H (WA residents add 8.2% sales tax). For more information, contact *Novatech Instruments, Inc., 1530 Eastlake Ave. E., Suite 303, Seattle WA 98102; (206) 328-6902.* Or circle Reader Service No. 206.

Number 19 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston, TX 77083

The AMSAT Annual Meeting

The 1992 AMSAT Annual Meeting and Space Symposium was held October 9-11 at Intelsat Headquarters in Washington, DC. Hundreds of satellite enthusiasts from around the world listened to the presentation of over two dozen papers, examined satellite models on display, watched as exotic devices were demonstrated and made contacts from a completely operational satellite station. For all participants, it was a great weekend.

Friday

The AMSAT activities in Washington began at high noon Friday, October 9th. Two concurrent seminar sessions were held that afternoon. One was the AMSAT and ARRL Education Workshop. Several topics were covered, all with the common theme of satellites in education.

The parallel program started with a presentation by Doug Loughmiller KO5I and Mr. Kim of the Korean Advanced Institute of Technology on the progress of KITSAT-A, now known as Kitsat-OSCAR-23. Bob Bruninga WB4APR discussed packet radio experiments via satellite and HF at the U.S. Naval Academy. He presented details on a location system using a GPS (Global Positioning System) satellite receiver coupled with a laptop, AX.25 TNC (Terminal Node Controller) and radio. These systems determine the position and course of a vehicle and broadcast the data using automatic "BTEXT" packet transmissions. A suitably equipped base station receives the transmissions and updates its database. Bob displayed a basic receive station at the symposium.

AMSAT Director Tom Clark W3IWI provided explanations of the recent changes to AMSAT's internal communications system on the Internet. A computer system in Southern California is responsible for processing and distributing AMSAT bulletins to packet networks, other Internet addresses and CompuServe. Recent upgrades for more efficient operation were outlined along with proposals for future enhancements.

Kent Darzi KD4MKD and Dennis Wingo KD4ETA updated the audience on the status of SEDSAT-1. This is a microsat-class satellite that will be flying as a secondary payload as part of NASA's Small Expendable Deployer System (SEDS). SEDSAT 1 will be placed in a circular orbit with a mean altitude of 730 km at 39 degrees inclination. Several amateur radio systems for analog and digital communications will be included with an array of scientific experiments to study orbital mechanics, the dynamics of tethered satellites and remote sensing.

AMSAT Director Joe Kasser W3/G3ZCZ provided an update on the French ARSENE project with information from Bernard Pidoux F6BVP. The ARSENE satellite will carry a Mode S (70 cm up and 13 cm down) analog (voice) transponder and a mode B (70 cm up and 2 meters down) AX.25 BBS running 1200 BPS AFSK. No special modems will be required to work the satellite's BBS, just a standard TNC. The satellite will have a slightly elliptical orbit around the equator with an altitude ranging between 20,000 and 36,000 km. Each orbit will take 16 hours.

Other Friday talks included a satellite gateway discussion by John Hanson WAØPTV, efforts on the AMSAT deep space exploration antenna project in Colorado by Jim White WDØE and a discussion of recent balloon experiments by our own *73* editor Bill Brown WB8ELK.

Saturday

Saturday morning started with a welcoming from AMSAT Director and President Bill Tynan W3XO. He was followed by Jim White WDØE and his description of microsat engineering test results. Bob Diersing N5AHD continued with information on microsat downlink error rates and file server operation. Before the day's first break, AMSAT-UK Secretary Ron Broadbent G3AAJ discussed the European perspective on worldwide amateur radio satellite efforts. The remainder of the morning sessions and some of those in the early afternoon were dedicated to the Phase 3 D program. AMSAT Director Dick Daniels W4PUJ moderated the pre-lunch talks while providing his own input on the system overview. Phase 3 D is an extremely ambitious international project to provide a satellite covering ham bands from 10 meters to 10 GHz. Signal levels from the spacecraft are planned for levels 10 times stronger than AMSAT-OSCAR-13. Receive capabilities are similar.

Dick Jansson WD4FAB provided details of the spacecraft structure and antenna efforts. Jack Colson W3TMZ described further endeavors with antenna designs, including patch antennas, short helix arrays and "backfire" systems. When complete, Phase 3 D will bristle with antennas.

Bob Twiggs of Weber State University presented data on the student construction of the spaceframe. The structure will weigh nearly 1100 pounds and have a solar panel and main body span of over 23 feet.

Tom Clark completed the Phase 3 D sessions by reporting on the results of his GPS receiver experiments. In addition to accurately determining location, the GPS units can be used to establish spacecraft orientation and locking onboard frequency standards.

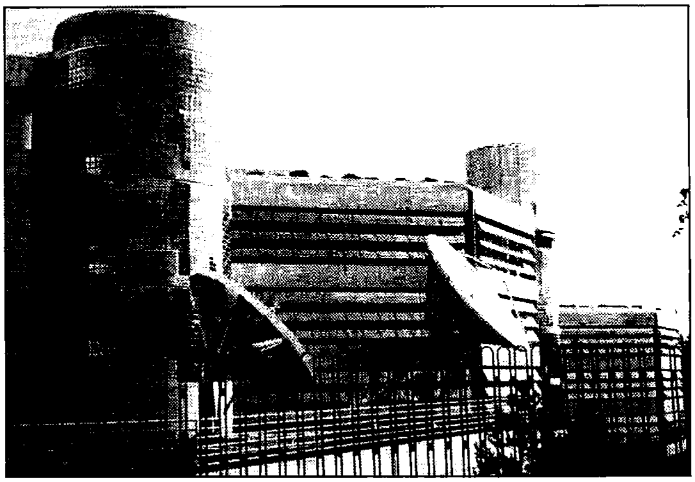


Photo A. Intelsat Headquarters in Washington, DC was the site of the AMSAT-NA 1992 Space Symposium and General Meeting.

Photo B. The Intelsat control room for satellite control operations was part of a tour offered during the symposium.

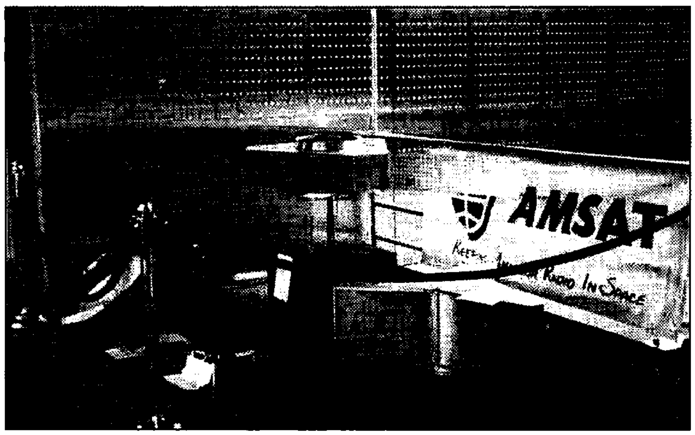


Photo C. A Mode S receive system, a microsat engineering model, a Phase 3 spaceframe and a Phase 3 D scale model shared display space at the symposium.

David Liberman XE1TU brought the group up-to-date on the status of UNAMSAT-1. This microsat, built at the Autonomous University of Mexico, is scheduled for a December 1992 launch on a converted Russian ICBM. In addition to a 1200 bps store-and-forward system similar to current microsats, this unit carries a 40 MHz meteor radar. The satellite uses DSP techniques to analyze echoes from meteor trails. The information is relayed to the ground using AX.25 packet telemetry transmissions. Dave described the effort in Mexico to finish the satellite and complete final testing.

Lou McFadin W5DID and Frank Bauer KA3HDO presented information on SAREX, the Shuttle Amateur Radio Experiment. Recent activities have been very successful and as many as five shuttle flights may carry SAREX equipment in 1993. One of these amateur radio missions is scheduled to have Sergei Krikalev U5MIR on board.

Other Saturday talks included an operations report from AMSAT Vice President of Operations Keith Pugh W5IU and a description of the AMSAT

Photo D. Bob Bruninga WB4APR demonstrated his system for satellite packet radio and auto-location experiments.

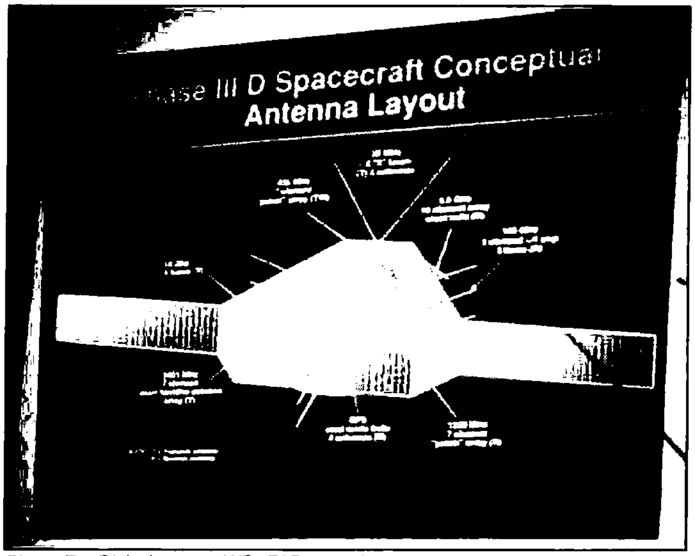


Photo E. Dick Jansson WD4FAB graphically explained the proposed antenna system for Phase 3 D.

Photo F. Previous AMSAT Vice President of Engineering Jan King W3GEY was recognized by AMSAT for his years of service since the creation of the organization in 1969.

Awards Program by AMSAT Director Andy MacAllister WA5ZIB.

The day finished with the AMSAT Annual Meeting, a buffet dinner, awards presentations, prize drawings and an inspirational talk from Astronaut Ron Parise WA4SIR. Ron took time out from a Cub Scout camping trip to show some shuttle video and discuss his radio activities from space.

Sunday

Sunday began with a beginners' forum hosted by AMSAT Vice President of Field Operations Mike Crisler N4IFD. Stephan Greene KA1LM followed with information on how to put together an effective movable antenna system for A-O-13. He made his point by bringing the array into the Intelsat building on a wheeled cart. Eric Rosenberg WD3Q provided some tips on DX via satellite. Eric has been both a DXer and rare DX and will be going overseas again soon with satellite-ready radio equipment. Ed Krome KA9LNV was the last speaker of the symposium. He described his low-cost Mode-S equipment for OSCAR 13 operation. Mode S uses a 70 cm uplink coupled with a 2.4 GHz downlink. Although this combination may seem difficult to use, Ed's results have been exceptional. He has tried different antennas for his experiments to a downconverter from Down East Microwave and a 2 meter multimode receiver.

A tour of the Goddard Space Flight Center followed for those who did not wish to attend the Board of Directors' meeting. Most participants took off for home late Sunday while those attending the Board meeting went to the AMSAT offices in Silver Spring, Maryland on Monday for continued discussions.

Symposium Committee Chairmen Ken Nichols KD3VK and Steve Todd K2IYQ worked with AMSAT-NA Secretary Martha Saragovitz and the rest of the crew to do a fantastic job of preparing and running the weekend events. Walt Daniel N3KVQ kept all the talks on schedule and made sure the timetable went smoothly. Next year's symposium will either be held in Texas or Florida.

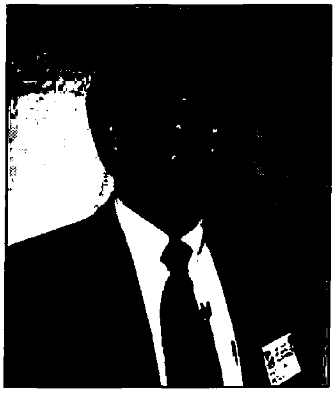


Photo G. Astronaut Ron Parise WA4SIR was the guest speaker at the AMSAT Saturday night banquet.

Copies of the Proceedings of the AMSAT-NA 10th Space Symposium are available from AMSAT or the ARRL. The book is 8 1/2" by 11", 300 pages long and softbound. It's well worth the cover price of $12.00. AMSAT can be contacted at 1-213-589-6062 for details on shipping charges. 73

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KOOV
P.O. Box 2508
Fullerton CA 92633

Photo A. (Left to right) Course Marshall Gary Holoubek WB6GCT watches as Deryl Crawford N6AIN, Tom Mirabella KD6AAN and Tom's father, Ken KM6YH, swarm around a kiddie fort in the park. They know they're close to the second hidden transmitter at the 1992 ARRL National Convention T-hunt.

Photo B. What strange indications! Eric Nansen N6YKE (foreground) and Richard Heryford WD6ESZ are momentarily mystified by the real and decoy signals. The hidden T is in the center of the picture, concealed under the base of the ramp. You can't see the tag, because it's in the shadow.

Crowning the Champs

Baseball has the World Series. Football has the Super Bowl. Most sports have a national championship to determine which team is the best of the best. In ham radio, Field Day is the biggest annual club QSO competition. But hidden transmitter hunters (called foxhunters or T-hunters) hold their mobile radio direction finding (RDF) contests only on a local basis.

Is it time to start thinking about regional foxhunting tournaments, or perhaps national championship matches?

I think plenty of RDFers would be interested. Southern California hunters claim that there are no tougher hunts, and no better T-hunters, anywhere in the world. (No one ever called them humble.) I'm sure that their counterparts in other parts of the country feel they are just as good.

"Is it time to start thinking about regional foxhunting tournaments, or perhaps national championship matches?"

Hams in Great Britain test their mobile foxhunting abilities with a tournament each year. There are qualifying rounds in various cities, followed by the National Final Championship in September.

Countrywide championships are practical in Britain because the nation is small and a standardized set of rules has been developed over the years. In the USA, it's completely different. Our country is so big and its geography is so diverse that regional hunting practices vary widely.

For example, most Los Angeles area hunt boundaries are large and include both urban and high mountain terrain. The 6's love weak fox signals. They don't mind installing long beams or quads on their vehicles and using low-noise preamps. Lengthy all-day and all-night hunts are well attended. Lowest odometer mileage determines the winner.

A few hundred miles away in Phoenix, T-hunters want the game to go much faster. They favor Doppler type RDF sets, which require much higher signal levels from the fox. The first team to find the T wins.

There are no mountains to bounce VHF signals in Nebraska, so hiders there add difficulty to the hunt by making short transmissions, with long periods of no signal in between. And so it goes.

How shall we develop a set of rules for championship hunts that are acceptable to RDFers in those three places and everywhere else in the USA?

How do we satisfy both the low-mileage-wins and first-finder-wins camps at the championships? Must we have separate categories? A combination of time and mileage is probably unacceptable to both. Let's hear your thoughts.

Hunting for Dollars

ARRL conventions host the only area-wide T-hunt competitions in the USA right now. A worldclass mobile hunt has been a feature of every Southwestern Division convention for many years, complete with prizes for the winners. Hams from all over Southern California and Arizona are invited.

When the ARRL National Convention came to Los Angeles this year, the Fullerton Radio Club (FRC) was selected to put on the convention hunt. The convention committee told FRC to invite everyone and pull out all the stops. The hunt had to be challenging, but fun.

FRC designed the hunt to test the abilities of 2 meter DFers both in and out of their cars. The hunt committee settled on a three-segment contest, with prizes for first, second, and third in the overall scoring, plus a prize for the winner of each segment.

The first requirement for the 22 participating teams was to find a station that was 13 miles south of the convention hotel in a park. Transmitter power changed every second, varying from 15 watts to a few milliwatts. Hunters with beams and S-meters had to keep one hand on the mast and the other on the attenuator switches.

Segment number two was an on-foot "sniffer" hunt in the same park, with some unusual twists. Contestants were told that their point score would equal the number of minutes it took the team to identify the numbered tag on the fox, and that the team with the shortest time would win the hunt.

They were warned that there would be decoy transmitters and antennas nearby. Every time a team member reported a wrong tag number, the team would be given a 10-point penalty. This forced the hunters to carefully use their equipment as well as their eyes.

Their RDF sets showed lots of RF coming from a kiddie play fort in the park (Photo A). In addition to the real 20 milliwatt T, there were two half-watt decoys, plus an audio decoy and a non-transmitting mag-mount. Selective switched-antenna RDF sets worked best, but gave confusing indications at times (Photo B). The mag-mount (Photo C) was incorrectly guessed many times, resulting in lots of penalties and much running back and forth to the check-in station.

Most teams eventually found the real bunny under the ramp to the kiddie fort. Only its tag was visible (Photo D). But no one identified the antenna. Some thought the T was connected to a dummy load. Actually, the antenna terminal was wired to the entire chain-link handrail on one side (Photo E). The end of the chain was only a few inches from the decoy mag-mount.

Clarke Harris WB6ADC was captain of the team that won this part of the hunt. His sniffing crew (Gary Crist KI6FG, Ken Stroud AB4RQ, and Gary's sons Mike KC6DCR and Brian) ferreted out the right signal source in a little over 10 minutes, with no penalties. That was so good that the WB6ADC team ended up taking first place overall, even though they were not winners in the other two hunt segments. Other scores on the sniffer hunt ranged from 17 to 96 points.

From the high elevation of the park, most teams could hear transmitter #3, which was 44 miles away in the Ange-

les National Forest, running five watts. The beam was pointed at a nearby mountain, in hopes of giving misleading bearings.

No Wimps Allowed

From an international standpoint, our mobile T-hunts are the exception, not the rule. Only in Britain, Japan, and North America will you find regular opportunities to hunt in your car. Everywhere else, it's all done on fool and the participants consider themselves lo be amateur athletes. There are no big-dollar prizes to be won, but plenty of fame, glory, and nice medals.

This form of radiosport is most popular in eastern European countries, where it is a part of physical education in the schools. It's also active and well organized in Scandinavian countries, and in Japan and China. National on-foot foxhunt championships take place annually. The International Amateur Radio Union Region 1 Championships provide inter-country competitions every two years.

Stateside hams got involved in European/Asian style foxhunting for the first time in 1989, when the first Friendship Radiosport Games (FRG-89) were held in Khabarovsk, a city in Asiatic Russia. Five hams from Portland, Oregon, traveled to Khabarovsk for a foxhunt, a CW contest, and an HF QSO contest.

The Games grew out of a Sister Cities International exchange program. The hams of both countries had so much fun that they formed the Friendship Amateur Radio Society (FARS). One goal of FARS was to put on the Games every two years.

Portland hams reciprocated by holding FRG-91 in their city. (See "Homing In" for September 1991 and "Showdown in Portland" in the November 1991 issue of *73 Amateur Radio Today*.) This was the first internationally sanctioned foxhunt competition on US soil. It drew entrants from the USA, Japan, and Russia.

As good-byes were exchanged in Portland, every participant was eager to begin planning the next Friendship Games. Where shall we meet in 1993?

Just after the 1991 Games, Evgeny Stavicky UWØCA, Chairman of FARS-Khabarovsk, sent an open letter to the hams of Victoria, British Columbia, another sister City of Khabarovsk. He told them that they had much to gain by becoming Involved in the activities of FARS.

The hams of Victoria jumped at the chance. They met with FARS-Portland leaders and set up on-air contacts with the Russians. When UWØCA came to Oregon for a convention in June of this year, the planning for FRG-93 began in earnest.

Perry Creighton VE7WWP picks up the story: "After meeting the Russians in Seaside, we brought UWØCA and two others to Victoria and spent three days with them. We agreed that we would host the 1993 games up here, and extended an invitation to 14 of the Khabarovsk hams to come over.

"While the Russians were in Victoria, we were very fortunate to get them involved with Camosun College. The college agreed to co-sponsor the Games and provide logistical support." FARS-Victoria was formed, with Martin Dunsmuir VE7BDF as president. Martin Is the electronics instructor at Camosun College.

The Games are now scheduled for June 24 to 27, 1993, which happens to coincide with Field Day weekend. FARS-Victoria Vice-President VE7WWP says, "Our intent is to run a special events station, a Field Day station, and the Games all at the same time. We want to have a hamfest with a flea market and commercial exhibits, too."

When I asked if Field Day activities would detract from the Games, Perry told me, "Field Day is not that big a thing in this part of the world. We have a thousand hams in the greater Victoria area, but we have been able to round up maybe 25 people at best for Field Day In the past.

"If all other things could work out," he added, "we would throw it a week later, which would be over the July 1st Canada Day weekend. But internally we have a lot ol problems with availability of people who can do the various things that we need to have done at that time."

Besides participants from the USA, Canada, and Russia, hams from around the world are invited to take part in the Games. Japanese foxhunters scored well at FRG-91, and will be invited back. VE7WWP says, "The more the merrier. The college wants us to bring people in from around the world. The Russians will be transported and housed by local hams. We will do our best to arrange billeting for others, depending on the response we get."

Start Planning Now

So here is your chance to participate in an international foxhunt competition. Many of the Russians will be bringing their families, so be sure to include yours. You won't need overseas plane tickets, because Victoria is only 75 miles by ferry boat from Seattle.

It's a beautiful British city where you can find both cricket matches and totem poles. Plan some extra time for Victoria's traditional high tea at the Empress Hotel and a visit to Butchart Gardens. Find out what a "rockery" is.

For more Information, or to register for FRG-93, write to FARS-Victoria, c/o Camosun College, Box 128, 3100 Foul Bay Road, Victoria, British Columbia V8P 5J2. Remember that the letter rate for mail from the US to Canada is 40 cents per ounce.

Membership in FARS-Victoria is open to anyone, ham or non-ham. So even if you can't participate in the Games, you can join this non-profit organization and support the program. Write for a membership form.

Photo C. Many hunters, including Jerry Hughes KC6YMP, were certain that this tagged horizontal mag-mount antenna belonged to the hidden T. But its coax was not hooked up. The actual emitter was the chain, just inches away.

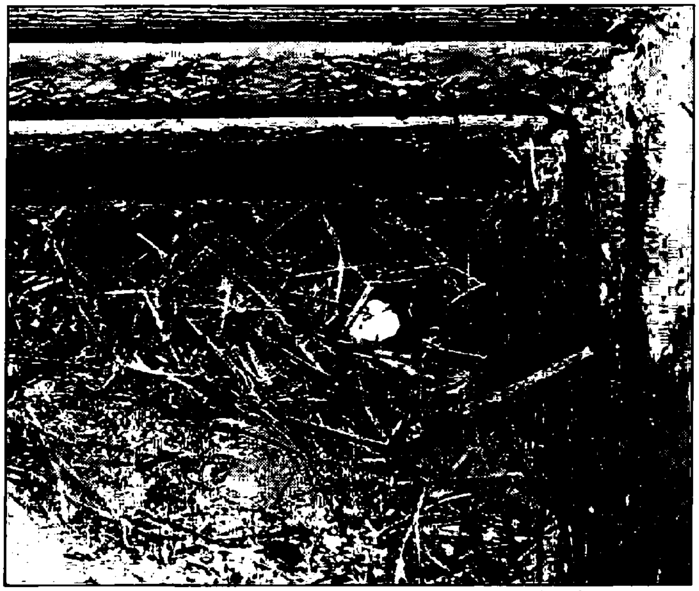


Photo D. No, it's not a bird's nest in this flash photo. You can barely see the tag on the real 20 milliwatt hidden transmitter concealed under the ramp.

Photo E. Several hunters walked right over this antenna connection. A corroded piece of wire ties the transmitter under the ramp to the chain/antenna. Can you see it?

Number 21 on your Feedback card

PACKET & COMPUTERS

Jeff Sloman N1EWO
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Good News About the Internet

My request for help in locating an Internet-to-AX.25 gateway certainly caused some activity. I received several Internet mail messages with information about the NØARY gateway/(P)BBS in Sunnyvale, California—and it is good news indeed. Those of you who are looking for a way to get packet messages to and from the Internet will find what you need, plus an unexpected bonus.

Bob Arasmith NØARY wrote the code that drives the BBS and gateway, which runs on a Sun SPARCstation under UNIX. He says, "It started out to be a PBBS, because I was disappointed with the network—rather than user—orientation of the popular PBBSs, I tried to include lots of user friendly features I didn't find on the other systems." Borrowing from his UNIX experience, Bob included user profiles in his code. This allows each user to customize the way the BBS behaves when they connect. Message list order and lines per screen are a couple of examples of user-settable parameters. But it grew from there. Bob added AX.25 to Internet mail forwarding capabilities. That's right, registered users can use NØARY as their home BBS, and have the SPARCstation forward packet messages they receive there to any valid Internet address, even CompuServe.

Pretty impressive, but his user orientation wouldn't let Bob stop there. "The Internet mail capability was fine, but it didn't let users choose 'reply' to answer packet-originated messages they had received; I had to add the gateway in the other direction," Bob told me. So now BBS users can send and receive packet messages from their Internet mail accounts. Users of CompuServe, MCI Mail, or another service that has an Internet mail connection can use NØARY to work all of their packet traffic, without ever keying a radio. The BBS has about 700 users, and a large portion of these never actually connect to it.

You say you don't have an Internet mail account, and you don't live in Sunnyvale, but you sure like the sound of the NØARY machine? Well, don't worry, Bob hasn't left you out. You can reach the NØARY BBS by telephone modem. In addition to the two TNC user ports, NØARY supports a dial-up connection that behaves exactly like a local TNC connect. You can reach the BBS at (408) 749-1950. When you connect, you'll see the prompt:

NØARY/BBS (type bbs) login:

Do what it says: Type "bbs" at the prompt. The BBS will prompt you for your call, and then look it up on a CD-ROM-based *Callbook* database and prompt for confirmation of the information. NØARY also maintains a local copy of the *White Pages* database, and will probably know your current home BBS. Once through the login process, the BBS treats you just like one of the "local" users connected by radio. If you happen to be line-of-sight to Sunnyvale, you might try connecting on one of the two TNC user ports—144.930 in the 2 meter band and 433.370 in the 70 cm band.

Two Types of Access

NØARY supports two types of user access. Local users are those who connect directly, whether by radio or by land line. The use profile maintained by the BBS keeps track of the user's preferences, including several "macros" that can be used to automatically list new messages when connecting—or almost anything else that can be done from the keyboard. The second user type is "remote," users who access the BBS via Internet mail. Remote users can send and receive messages from their Internet mail account, but there are two things that must be done first: registration and enabling email forwarding.

Registration and Enabling

Registration is simple. From the host you want to use, send a message to:

gateway-request@arasmith.com

The text of the message needs to include:

CALL: *(your call@your home BBS)*
FIRST NAME: *(your first name)*
CITY & ST: *(your city and state)*
ZIP: *(your zip)*

Note: If you omit a specific home BBS on the call line, you will be assigned NØARY as a home BBS. If you do supply a home BBS, make sure people who want to send you mail that ends up on the Internet address it to:

your call@NØARY
(e.g.:N1EWO@NØARY)

That's all there is to it. NØARY then adds the information from the message's "from" field and the call in the body in its registered user list. From then on the BBS will use that call when an Internet message—bound for packet—comes from that host and user. If the host and user are not registered, the message is "bounced"—returning it to the user with a one-line message indicating that registration is required.

The second step is to enable email

forwarding. Do this in one of two ways. The first is by connecting as a local user and issuing two commands:

email (your Internet address)

and

email on

NØARY will respond to the last command with:

Automatic EMAIL forwarding is ON

. . . and you are done. Beware that if you enable forwarding, the BBS will delete each message as it is sent on to the Internet address you specify, so be sure you have it right or you risk losing some mail.

The second method is to send the same commands as an Internet message to:

cmd@bbs.arasmith.com

You can now send and receive packet messages via the Internet mail system. Pretty neat, huh?

Sending and Receiving Messages

To send a message from the Internet to packet just send it to:

(call)@bbs.arasmith.com

or, if the user might not be known by NØARY (pretty unlikely, but . . .):

(call)%(BBS)@bbs.arasmith.com

To send mail in the other direction (that is, AX.25 to the Internet), send the message to:

IPGATE@NØARY

and, on the first line:

To: (Internet address)

The subject line can be anything you want. You can send the message from any PBBS, or from the dial-up connection to NØARY.

Additional Features

There are more features on the NØARY BBS than I can possibly describe here—the current user's manual is more than 130 pages long—so I'll just go over some highlights.

First of all, NØARY is a UNIX-based system and supports some commands that will be familiar to experienced UNIX users. For example, the file system—which contains text files of interest to hams—is accessed with the familiar CD (Change Directory) and DIR or LS (list directory).

Users familiar with WØRLI PBBS software will find that many of the standard commands work just as expected—the List command, for example. There is a help file available that lists translations of WØRLI commands. You can access it with the command:

INFO WØRLI

Keep in mind that this can be done via the Internet with the same method described for remote forwarding enabling (see above). The fact is, pretty much any command that does not require interaction can be done via the Internet, with the result coming by return mail.

Signature:

NØARY can store a "signature" for each local user, which it will attach to each message sent.

Vacation:

When you set vacation mode, NØARY will reply to messages sent to you with a "canned" message you compose. This lets the sender know that you will not be able to answer for a while. The BBS also holds the message for longer than it would otherwise.

Voice:

If you are lucky enough to be in the Sunnyvale area, you will be able to check for mail by using a 440 radio. The voice synthesizer will tell you the status of your mail account.

Keystroke Macros:

Local users—via phone or radio—can store keystroke macros that allow frequently used keystroke combinations to be accessed with a single key. These are personal, and part of the user's account.

After reading this, I'll bet you share my enthusiasm. When I asked Bob if he could handle a bunch of new users, he said "bring 'em on." When you get on, be sure to let Bob know that you appreciate all of his hard work setting up and running the BBS. So go ahead and use it—by phone, radio, or the Internet and have lots of fun. I have, so far.

"There are more features on the NØARY BBS than I can possibly describe here—the current user's manual is more than 130 pages long—so I'll just go over some highlights."

Mail

I've received quite a bit of mail, but I don't have the space this month to respond to it. I will next month, though—there's some good stuff. Thanks for writing to me; I appreciate every letter—in agreement or not.

Where to Reach Me

I just want to repeat the electronic addresses where you can contact me. The preferred address is jsloman@mcimail.com on the Internet. My packet address is N1EWO@NØARY.#NOCAL.CA.USA.NA, and least desirable is CompuServe at 71221,1143. Remember, if you want to talk to me about the column, with a question or suggestion, don't use the packet address. Instead, use the Internet or CompuServe. Feel free, though, to use any of the addresses to test your packet station—I am happy to help.

Number 22 on your Feedback card

ABOVE & BEYOND

VHF And Above Operation

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Filters for 2 Meters

This month I would like to finish up covering filters by offering details for a few different designs for a 2 meter filter. This filter is used to help prevent RF desensitization or RF saturation on your HT or similar transceivers when they operate near commercial high power VHF radio facilities. The design details that I will present are another attempt to construct simple fillers out of readily available component parts for home construction. The construction of filters, and for that matter almost any electronic project, can be quite intimidating if you do not have a well-stocked junk box. Most of us, myself included, have spent many hours trying to come up with components to construct a seemingly simple project, only to put it on hold for lack of malerials.

Here are a few designs for 2 meters that should be easy to construct. What makes these filters nice is that they can be constructed out of components from your plumbing or hardware store, or even your own kitchen. I have provided several basic designs to simplify the filter's construction. They can be adapted to your HTs as well as mobile rigs to reduce or eliminate desensitization when operating near commercial installations.

2 Meter Filters for HTs

The first filter was actually constructed for a low power 2 meter HT (5 watts) that could be used with a rubber ducky or conventional antenna. It can be used in line with a mobile transceiver but was built to be small and therefore is more suitable for low power HTs. In either case, the filter is used to provide attenuation higher in frequency where the offending signals lie. Operation without this type of filter near high power transmitters could shut off (or bias, active AGC, etc.) the front end RF stage of your receiver. If this is the case, your receiver will be dead when mountaintopping or contesting near high power VHF RF.

For example, during the ARRL 10 GHz microwave contest this year, filters of this type made the difference in being able to communicate from some of the more populated RF microwave mountaintop sites. The filter provides attenuation to signals above 150 MHz and very low loss to signals in the 144 to 148 MHz 2 meter band. This provides the needed filtering and attenuation to make operation quite manageable near high power RF sources. Most newer VHF radios do not have adequate filtering to prevent this type of out-of-band influence.

This first filter, constructed by N6IZW, uses two large ceramic adjustable coil forms half an inch in diameter and about two inches long. A coil is wound on each form with #12 enamel wire, almost filling the entire coil length with aboul 12 turns. Leave some room for pruning and varying the turn spacing on the form. Initially, the coil is wound tightly and then can be spread out to resonate as needed. The adjustable core makes this much easier. Each coil is taped at exactly one turn above ground, the 50-ohm point of connection. The two coils are positioned half an inch apart adjacent lo each other, within a metal box approximately 2-3/4" x 2-1/8" x 1-1/4" (the box size isn't critical). BNC coaxial connectors serve as input/output connections to the taps on each coil on our model, but you can use any connector you desire.

You need some means of injecting a signal through the two coils to determine just where resonance is, pruning, stretching or adjusting the slug-tuned coil form until minimum SWR or resonance is found. One method of adjustment is to couple a low power HT through the filter with an SWR meter coupled to a power meter and adjust for minimum SWR. Loss through the coils runs about 1 dB at 2 meters. Then check where the coil rolls off—it should start to give higher attenuation near 150 MHz and increase rapidly as frequency is increased. This coil and adjustable slug will not take a large amount of power, so limit it to less than 20 watts. Different designs and construction techniques are required for higher power. See Figure 1 for design details.

A variation of the slug-tuned coil design developed by N6IZW is to wind the coils out of #12 wire on a 5/8-inch mandrel and mount them without the coil form. The coils are positioned much the same as with the form but are now suspended in air and rigidly grounded at the bottom of the coil. Adjustment is more critical as we do not have any adjustable core to help in tuning. The coils must be adjusted entirely by stretching and adding or removing turns to bring them to resonance. Note: The metal chassis is the same size as the coil form version.

The colls are placed adjacent to each other, spaced the same half inch apart, and are resonated by the proximity to the metal case and tight coil-to-coil turn spacing and length of each coil. The RF input and output is placed at the one-turn point from the grounded end of each coll. Make this connection as direct as possible to the solder pin on the BNC connector. Excess length at this point will increase loss and reduce efficiency of the filter. See Figure 2 for design details of the air-spaced coil filler.

If your coil section does not resonate at the desired frequency you might have to add a turn or two; however, we have found in our container that 12 turns seems about right. The test results for this filter are as follows: 1 dB insertion loss; 10 dB rolloff frequencies at 119 MHz and 154 MHz. The 20 dB rolloff points are at 110 MHz and 164 MHz. The filter exhibits 1 dB ripple between 130 and 144 MHz. See Figure 6 for the frequency response curve of this filter.

Make sure that your coil structure does not touch the side of its cabinet (chassis) because it may present a problem to your transceiver. This filter can handle quite a good power level (it has been tested to 45 watts in mobile applications). I attribute this to removing the adjustable coil or air variable capacitor found in other designs.

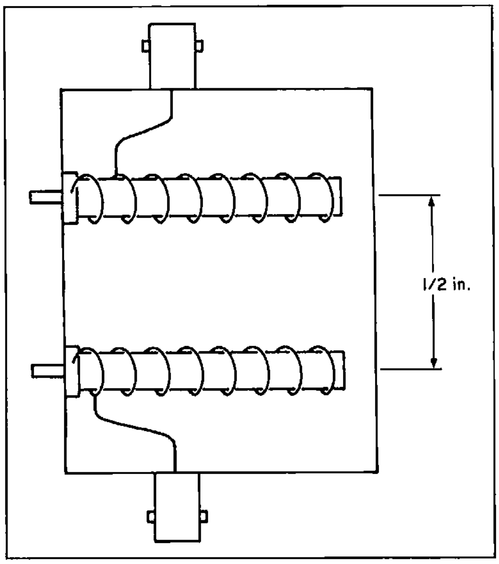

Figure 1. Variable coil 2 meter filter.

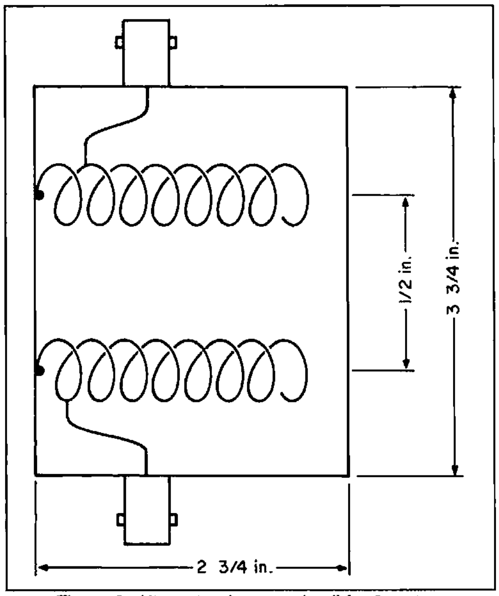

Figure 2. Alternate air-spaced coil for 2 meters.

Alternate Designs for 2 Meters

Alternate designs at moderate power levels can be accommodated by small air-variable capacitors and compact coil circuits that are contained in the same metallic enclosure. This enclosure can be as simple as one constructed out of PC board material, or even some suitably-sized chassis or box. When using PC board material be sure to use the double-sided variety. Ground both sides together at several places. I constructed one for 2 meters and had some very funny things happen because one side of the copper foil was not grounded. It gave some weird results—just ground the two sides together for minimum problems.

Another filter circuit for 2 meters using air variables can be contained in a box slightly larger than 2" x 4" x 1-1/2". The small size is due to bulk coil and small air variable capacitors in the 10 pF region to resonate the circuit. The ground end of the coil is a straight section of wire about an inch long with an 8- to 10-turn coil (half-inch diameter, spaced one wire turn, #12 wire) to bring the circuit to resonance with the trimmer. Tap the straight section at about the 3/4 to one inch above ground for impedance matching. Mount the coaxial connectors near the tap above ground on both coils. The taps are adjusted for proper match on the straight portion of the coil above the ground end of the coil. See Figure 3 for air space coil construction.

Proper position of the coil taps can be determined by operating the filter in the receive mode and adjusting for best receive performance on both input and output taps. Since you can verify filter operation in this manner, and because of the air variable capacitors, this filter can be used on other nearby frequencies, either higher or lower. This eliminates the need for the test equipment normally required to align the circuit (allowing operation with a scanner, for instance). After this basic alignment, check it out with an SWR meter for final settings.

Normally for 2 meter use we measured 10 dB attenuation at 150 MHz, and at 152 MHz it ran near 20 dB loss. The purpose of the straight portion of the coil circuit near the ground end is to remove the lumped coil circuitry and provide a portion of transmission line length for a short section to facilitate matching and allow room for the coaxial connectors for short connections.

The coil with a section of transmission line attached is similar in construction to a limited-space antenna—for instance, if you constructed a dipole "slinky" antenna by distributing the coil of the slinky out in each direction for the desired dipole length. This type of antenna, constructed entirely out of a coil for its entire length, would not give good performance. Now, if you spread out a few turns of the slinky coil (end section), producing a near straight section on each end of the dipole, the "slinky" antenna will now show better resonances and vastly improved operations vs. a bulk coil design. This is a limited-space antenna; the filter is a limited

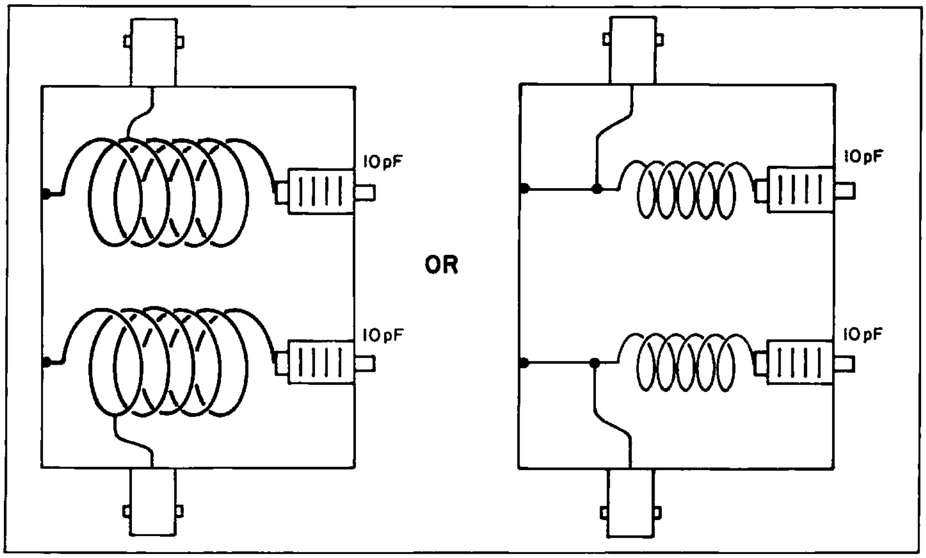

Figure 3. Variable capacitor designs.

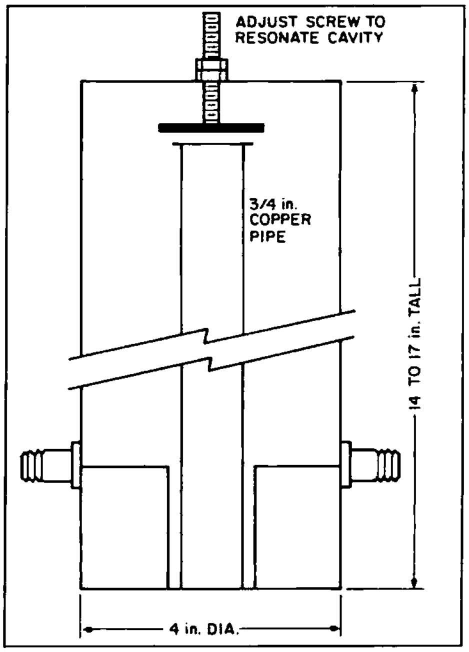

Figure 4. High power cavities (quarter wavelength).

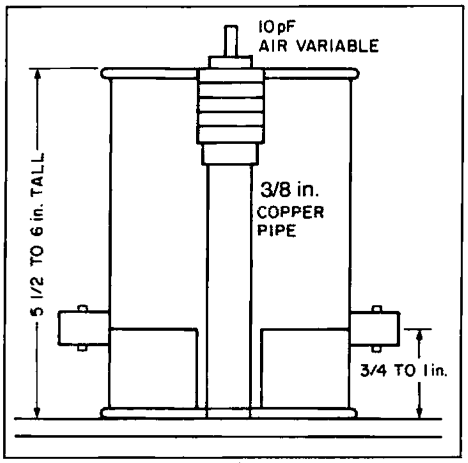

Figure 5. Tin can filter for 2 meters.

space coil—the principle is nearly the same.

Component RF Heating

If you think component healing due to RF is not much of a concern, let me tell you about a 6 meter amplifier I built. This amplifier depicts heating to an extreme. The circuit was a single-stage amplifier using a half-turn input and output inductor for the tank circuit. Initial tests showed very low output power. I made adjustments but there wasn't any particular improvement.

Soon I realized where my errors were. Due to long key up, the output coupling capacitors were squirming about the PC board in a pool of molten solder! The capacitors were dissipating so much RF current they conducted heat to their leads and melted the solder. The trouble turned out to be that the half-turn inductor was just too short. The cure was simple: increasing the inductance a small amount. I changed the total length by adding 1/8 inch of #12 wire, making the total inductor length now 3/4 inch long for its half-turn loop.

Testing after this change produced output power of 80 watts with little trouble. Now it would have worked at the 45-watt level, but for how long? Check out RF heating of the components—it is very important to remain within good engineering ratings.

High Power Cavities

Designs for higher power levels require a more traditional cavity design, allowing very high RF currents to flow through large conductor surfaces. The air-spaced multi-rotor capacitor is replaced by a single top-loading capacitor, or changed by adjusting the center element length along with cavity length to make it resonant. This tends to make the size large because the center element must be very near 1/4 wavelength to be resonant, either by minimum capacitance or by element length, making circuit "Q" quit high. A cavity for 2 meters will be quite large, something very near four inches in diameter and between 16 and 20 inches long.

The top of the cavity usually consists of a single capacitor hat to bring the cavity to resonance. Several cavities can be grouped together to form a diplexer. The cavities in a diplexer configuration will isolate receive and transmit frequencies from a repeater, connecting them both to a common antenna. Diplexers usually consist of four to six cavities for a single pair of frequencies. There are two sides to any diplexer, with half the cavities split between receive and transmit.

As shown previously, simpler cavities can be constructed more compactly by replacing the end element with an adjustable capacitor fixed between the end element and ground. You just have to remember that the capacitor is the power-limiting component here. See Figure 4 for a single cavity for high power use. Additional multiple matching lines and cavities can be used to construct a diplexer that is not unlike most repeater diplexers in use today.

As shown in Figures 1, 2 and 3, the length of a cavity/tuned circuit can be reduced by using bulk components. This allows small tuned circuits to act as filters, with the limitation of lower power operation. Use small 1 to 10 pF variable capacitors. I limit this type of design to the 10-watt level just for a component rating margin. You can push it but be cautious—don't worry about your capacitor, worry about the failure the short will do to your solid-state power amp in your rig.

The Tin Can Filter

The simplest filter to construct is the Tin Can Filter. For this filter all you need to do is to punch a hole in the top of a can (a little longer than a soup can) and add a variable capacitor, soldered to a central copper rod or pipe. Ground the bottom end of the pipe to a plate that connects common to the end of the open can. Taps for the input/output are constructed out of #12 buss wire one inch high and placed in close proximity to, then routed directly to, ground, next to but not touching the central element. The two connections or loops are placed 180 degrees apart. Adjustment is also simple: Connect to an existing system and adjust for maximum signal strength through the filter. Please note that this is a sharp bandpass filter and will be limited to a couple of hundred kHz. This type of filter is intended for spot frequencies only. See Figure 5 for details. It is a very non-critical filter to construct. Adjust all filters on receive for best performance and then test on low power with an SWR meter to find the best match.

Next month I plan to describe a noise generator that you can use to check out your receive systems for best performance. It's quite a simple project, with the noise head having less that five parts.

Well that's it for this month. I hope you and yours have a very merry Christmas and a happy New Year. As always, I will be glad to answer questions concerning filters and other related VHF/UHF matters. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

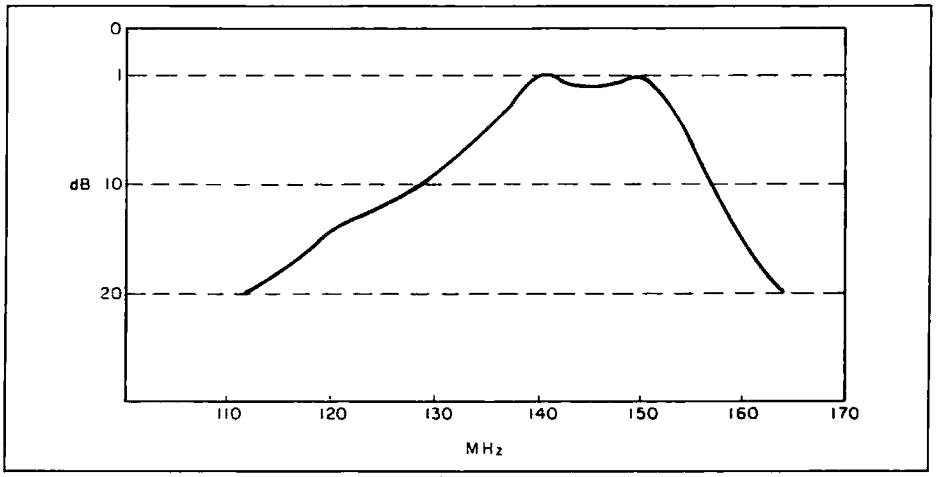

Figure 6. Frequency rolloff typical of 2 meter construction.

Number 23 on your Feedback card

HAMS WITH CLASS

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Staten Island NY 10313-0006

The Art of Grantsmanship

If you are a teacher in a public school, sooner or later you will find yourself in the position of needing or wanting more money for your classes. If you are a teacher using amateur radio in the classroom, you will definitely discover the benefits of having a cash flow at your disposal. While there are many grants and scholarships specifically aimed at the amateur radio community, you should not limit yourself to applying for only those offerings. When it comes to bringing funding into your school for your program, you should leave no stone unturned. In this column I'll pass along some basic tips for good proposal writing, and give you some resources to help you get started.

Private Sources

With all the budget cuts going on in government today, the trend for funding is shifting from the public to the private sector. The list of foundations awarding grants to elementary and secondary schools and community and nonprofit organizations continues to grow. Sometimes, finding a starting place is the most difficult task.

As an aid in finding that starting place, Government Information Services and the Education Funding Research Council have compiled a list of 60 foundations to contact for funding for your program. I'll list a few of the foundations, along with the general type of support they offer. This information is intended as a starting point only. Anyone interested in specific foundations should contact them individually by mail. Address query letters with the contact name, followed by the name of the foundation and the address listed.

Alcoa Foundation: Awards for education, arts and cultural programs, community development, and youth. Uses: special projects, seed money, equipment, budgets, research, emergency funds. Contact: Earl Gadbury, Pres., 1501 Alcoa Bldg., Pittsburgh PA 15219; Telephone: (412) 553-2348.

Coca-Cola Foundation: Awards for school improvements, literacy programs, arts and culture. Uses: scholarship funds—commitment to $50 million over the next 10 years. Contact: Margaret Cox, Vice President and Executive Director, 310 North Avenue, Atlanta GA 30301; Telephone: (404) 676-3740.

Exxon Foundation: Awards for elementary, secondary, and higher education Uses: special projects and budgets. Contact: Dr. Arnold Shore, Exec. Dir., P.O. Box 101, Florham Park NJ 07932; Telephone: (214) 444-1104.

Alfred P. Sloan Foundation: Awards for science and technology. Uses: seed money, research, special projects, general. Contact: Albert Rees, Pres., 630 Fifth Avenue, 25th floor, New York NY 10111-0242; Telephone: (212) 582-0450.

Amateur Radio Sources

Many amateur radio organizations offer scholarships and grants to young people involved in the hobby. The *Quarter Century Wireless Association* and the *Dayton Amateur Radio Association* are two of the more well-known groups that can be contacted for specifics about their awards.

The ARRL Foundation has established the *Victor C. Clark Youth Incentive Program,* with the objective of providing support for the development of amateur radio among high school age youth. The Victor C. Clark award is funded by an endowment, and will be awarded as a mini-grant to groups who are high school radio clubs, youth groups, and general interest radio clubs sponsoring subgroups for young people or otherwise making a special effort to get them involved in club activities. For further information about this grant, contact: Mary Schetgen N7IAL, The ARRL, 225 Main St., Newington CT 06111; Telephone: (203) 666-1541.

Government Funds

Let's not forget that our Congress wants to help improve math and science instruction, as demonstrated by the $125 million allotment for the fiscal year 1990. Funds are allocated to each State Educational Agency annually, and at least 90% of these monies filter down to the Local Educational Agencies (LEAs) requesting them.

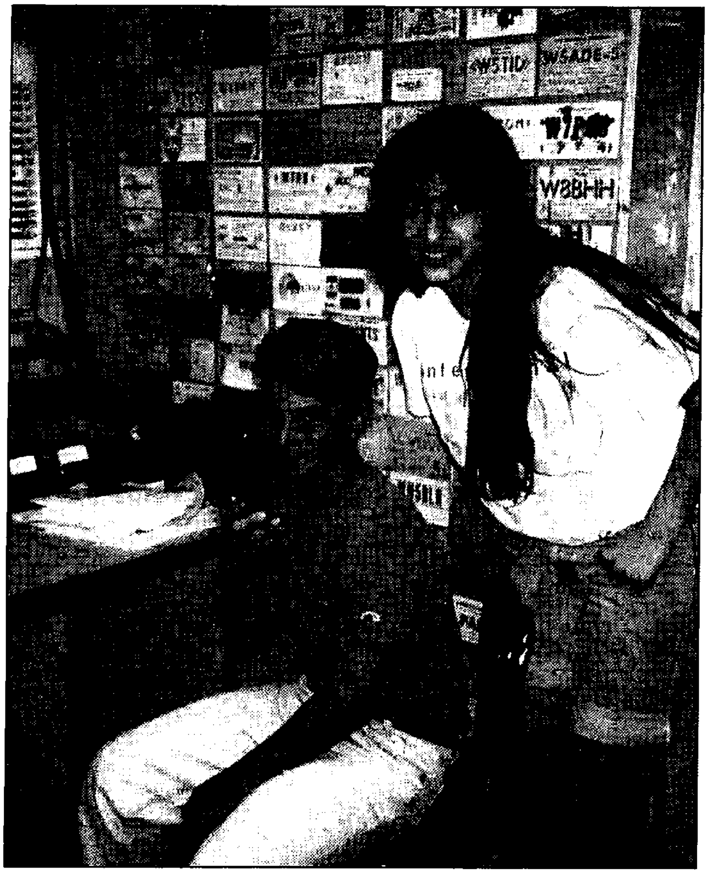
Teachers should first make their needs known to their curriculum director or department head. District supervisors review all teacher "wish lists" in committee, with some districts determining a priority list through the use of collaboratives that include university, museum, and local business representatives.

From a prioritized list, the LEA can apply for the Eisenhower funds in the form of a specific grant. *LEA Title II/Eisenhower funds* can focus on the local community but must support activities related to statewide priorities. Because the purpose of these funds is to improve the quality of math and science instruction, other disciplines cannot request grants from this allotment.

Keep Trying

I'd like to caution you not to be discouraged if your amateur radio project doesn't seem to fit into a pre-existing category for grants. Many times the grant will be awarded because of its unique approach in teaching and its obvious value to the community for good will and assistance.

Don't forget to inquire into possible grants from your *local utility companies.*


Doing creative lessons with amateur radio in your classroom gives you an extra "slant" in writing your grant proposal. Eighth graders Jason and Jo Ann gain valuable operating experience at the ham station.

Public utilities often offer many free materials and are receptive to sponsoring educationally sound programs.

In our community on Staten Island, New York, we have been very successful in convincing the *McDonald's and Burger Kings* to be supportive of our radio programs in the schools.

Another good idea is to approach *local businesses*, especially electronics companies, and offer to publicize their names if they can offer assistance, materials, or equipment.

You can request through your local school district office to receive the "Office for Sponsored Research," a biweekly update of available grants for education.

Writing the Proposal

Some helpful hints to keep in mind when you write your proposal:

Pay attention to the appearance of your paperwork. The reader will definitely be influenced, pro or con, by the readability (font and size of type used) and neatness of the proposal.

Be very specific about the objectives in your proposal. Although many funding sources do not require a Program Overview or Abstract, it is important to write one and place it before the narrative. In one page, the Program Overview or Abstract should briefly describe your project. It should state who is developing the project, the specific goals of the project, the problems or needs the project will address, the target population, the activities you have selected to solve the problem addressed by the project, and what you expect to accomplish.

Follow all agency guidelines. Make sure you have included everything that is asked for.

Double-check for spelling, grammatical or typing errors.

Include appropriate statistics and research. Refer to recognized studies and research programs.

Have other people review and critique your proposal before you hand it in.

Be persistent.

Some good resources for writing proposals can be found at your local library. Among them are: Ammon-Waxler and Carmel, *How To Create A Winning Proposal* (Santa Cruz: Mercury Communications Corporation, 1978); Stewart, *Proposal Preparation* (New York: John Wiley & Sons, Inc., 1984); and Manning & Rugh Associates, *Proposal Management Using the Modular Technique* (Los Altos: Peninsula Publishing, 1973).

Using amateur radio in the classroom as a highly motivational tool for teaching other curriculum gives you a unique and innovative slant in your proposal. Take advantage of the "special" way you approach education, and explore the opportunities for bringing funds into your classroom. Be sure to write to me and let me know how you did with your amateur radio proposal: Carole Perry WB2MGP, P.O. Box 131646, Staten Island NY 10313-0006. Good luck!

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The "Oscillator from Hell" Returns

Another year is about to bite the dust, so this month we'll tie up whatever loose ends are laying about and dig into the mail bag.

One of the columns that brought a ton of mail (including some hate mail) to my house was the "Oscillator from Hell" column. Seems even though the soldering iron lays cold, that oscillator continues to cause me trouble.

First things first: The schematic shown in the column had a missing ground connection on the tuned circuits. Many of you may be thinking to yourself, "It's no wonder it did not work, he had no ground on the tuned circuits." Well, there was a ground connection; in fact, several ground connections, to be triple sure the tuned circuits were not floating above ground.

Oh yes, I did manage to get the oscillator to work. I had to remove the 1N914 diode from the FET. That diode seemed to clamp the oscillator so much as to inhibit it from working. Removing the diode caused the damn thing to start working.

The original circuit came from a Doug Demaw QRP notebook. I talked with Doug at the 1992 Dayton Hamvention about the trouble I was having and he told me he encountered no trouble getting the circuit to work. In fact, he had a finished version of the DC receiver using the very same oscillator. I'm still not sure why I've not been able to get it to work as it should.

But, I've had quite a few really good answers to my question of why it did not work. For those who did take the time to write, thanks! I replied to all the letters and sent along a complete schematic of the project I was trying to get to work. Many of the letter writers suggested a different type of circuit altogether. The oscillator circuits were split about half and half between using an external active device in a VFO circuit or using the on-chip oscillator of the NE602. A good example of using the internal oscillator of the NE602 as a direct conversion receiver can be seen in both the Sudden and the Neophyte receivers. Both use the NE602 mixer as an oscillator for the VFO and front end (mixer) of the receiver.

I've included some of the better schematics for those wishing to build up a working VFO for their projects. I've not had the time to reproduce them, so it's builder beware! There is no guarantee they will work and experimentation will be needed. I hope this is the last I hear from the oscillator from hell!

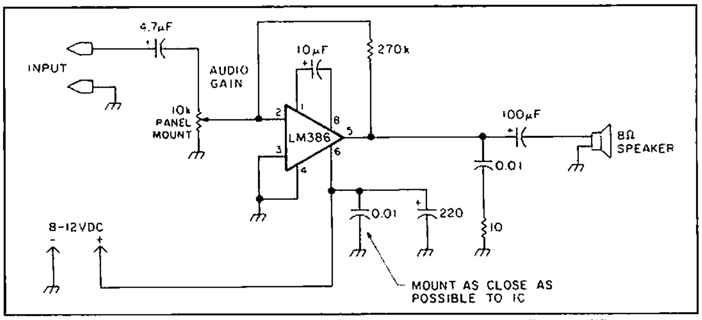


Figure 1. Schematic for a simple general purpose audio amplifier.

QRP Frequencies

I've received requests for the QRP frequencies, too. I've had these in the column many times, but here they are again. You'll find QRP operators on or near these frequencies: 3.550, 7.040 (and look for G-QRP members on 7.030) 7.060, 10.105, 10.115, 10.123, 14.060, 21.060 and 28.060 MHz. There seem to be no special QRP frequencies for the WARC bands, and the ones I have listed for 30 meters are not backed by any group or club. I don't know of any QRP calling frequencies on the 18 and 24 meter bands.

If you're really into milliwatting with the FireBall transmitters (November 1990), then look for others chirping away on 28.060, 28.322 (CW or voice) and 28.636 MHz. The Fireball transmitters run about 50-60 milliwatts. You'll be surprised how far you'll be able to talk with that much power on 10 meters.

A Simple Audio Amplifier

I've been asked by several readers for a simple general purpose audio amplifier. I've got just the thing you need! (See Figure 1.) It's simple, easy to build and works like a champ. You'll be able to get all the parts from Radio Shack. There is no PC board, but you should have no trouble putting this circuit together on a small piece of perfboard. I use the stuff the shack has hanging on the wall; it has a copper pattern on one side of the board, making it very easy to solder IC sockets and other parts to the board.

A LM386 is the heart of this project. I know, why use the 386 when there are so many different (and better) audio amplifier chips available? Well, number one, Radio Shack has this part hanging on the wall! The 386 is normally easy to tame and you'll get about 500 mW of audio from it. It won't rattle the front windows, but it provides more than ample audio for most projects.

A low value capacitor couples audio into the 10k pot. This is the gain control (volume) and should be a panel-mounted part. The speaker is coupled from the output of the 386 via a 100 µF capacitor. Don't forget to add the 0.01 cap and the 10-ohm resistor on the output of the 386. Also, don't forget the de-coupling capacitors on the VCC line either. If you are using an external power source for the amplifier and the amplifier breaks into oscillation, you might want to increase the value of the 220 µF capacitor. Doubling or even tripling the value of the 220 µF capacitor may be needed to tame the 386 audio amplifier.

Construction is so simple, we'll keep it very short. Use a socket for the LM386 and keep the leads short to and from the chip. After you have assembled the circuit, test it before you put it in a box. Apply +8 to +12 volts and check to be sure there is voltage on pin #6 and nothing (GND) on pin #4. You can use a standard 9-volt battery to run the amplifier, but it won't last too long. A better way would be to use a 12-volt supply. Steal this from any source you might have in the shack. But, watch out for the wall sucker transformers. They're usually not very well filtered and may cause the entire circuit to oscillate and hum badly.

Testing is simple. Turn the gain control all the way up and, using your finger as a noise source, touch the audio input jack. This should produce a loud hum in the speaker. Button the unit up in a cabinet of your choice. I installed my unit in one of the plastic project boxes from Radio Shack. RCA jacks are used for audio input, as well as a standard 1/8-inch jack. I placed the speaker inside the project box. A coaxial jack allows me to power the amplifier from a variety of sources.

I now have a handy universal audio test amplifier—just the thing for testing out a direct conversion receiver or for using as a troubleshooting aid in receiver repair. I guess it would make a good audio add-on for a crystal set, too!

Looks like that's all the space this month. If you like what you've been reading here in the "QRP" column, then by all means send in the reader Feedback card. If nothing else, you might win a free subscription (or renewal) to *73 Amateur Radio Today*! Also, if there is something you would like to see in the column, ASK! I can be reached via CompuServe (73357,222), America online (Michael 1087), and Prodigy (PPGJ40E). Of course, I have a large mail box and a friendly mail person, so USPS works just fine, too.

73 INTERNATIONAL

Number 25 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

I was very disheartened when I opened a letter from Vaughan Henderson ZL1TGC while preparing this column. He reports the Silent Key status of Des Chapman ZL2VR, 73 Hambassador for New Zealand. Des has been a regular contributor to 73 for many years and always served his country well with his timely and informative reports. His presence will be missed by ALL hams throughout the world.

Vaughan has volunteered to become the new Hambassador to New Zealand. I have reprinted his very informative letter to me under the New Zealand banner.

A letter from the Republic of Slovenia gives us some hope as to the well-being of the ham population there. One ham club developed an introductory ham radio course and graduated 14 young hams. This effort then caused the development of a ham radio club with a clubhouse. Just think what could happen if all of our cities, large and small, ran ham radio courses just once a year!

Fourteen new hams each year seems so very small when you look at it as just an individual news item, BUT what if those 14 were multiplied by the number of cities where there were at least one licensed ham willing to dig down and spend several hours a night for about 11 or 12 nights? I have even heard of "cram" sessions lasting just a weekend, preparing students to take the licensing examinations.

What's two hours a week for 12 weeks? I know I can waste that much time very easily just sitting in front of the television, probably more like two hours a night. All it takes is for someone (maybe even YOU) to mention the idea of having ham classes, giving something back to your hobby.

I mentioned that a group of hams in the Keene, New Hampshire, area did just that during the late spring, and the experience was so rewarding that we all agreed immediately following the last session that we wanted to do it again in early 1993. I am very happy to report that all (approximately 30) of the students who completed the course now have a ham license of some sort and that one has completed his Advanced. They are all very enthusiastic about the hobby and some have even volunteered to help during the next course. If you have never experienced the feeling it gives to be one of the teachers, there is nothing like it. As one of the US TV commercials says, "Try it, you'll like it!"

Lastly, this is a very special time of the year for many of our readers. I wish that each and every one of you has a very joyful experience and begins the New Year with the joy in your heart of Peace On Earth, Good Will Toward Your Fellow Man.—Arnie, N1BAC.

Roundup

Philippines *Letter from Rene A. Aguinaldo 4F2IR:* Special Event Station 4G2BAG, commemorating the 83rd founding anniversary of Baguio City, Philippines, was conducted by members of the Benguet Amateur Radio Operators Network Society (BARONS, Inc.) and the Texas Instruments Amateur Radio Club (TARC, Inc.), both duly licensed and recognized amateur radio service clubs by the Philippine Amateur Radio Association and the National Telecommunications Commission of the Philippine Government.

Baguio City, the summer capital of the Philippines, is approximately 250 km north of Manila in the Province of Benguet. It has an elevation of about 1.5 km above sea level and an average year-round temperature of 18 degrees centigrade.

Operation was conducted starting at 0000Z 26 August to 2359Z 7 September 1992 with phone and CW on the 40, 20, 15, and 10 meter bands only. A temporary operating permit was provided by the National Telecommunications Commission Regional Office #1.

Participating operators were: Renato DU2BAD, Gel DU2RK, Alvin 4F2AWE and Rene 4F2IR. Olher members of both clubs provided the logistics and financial support. BARONS and TARC were also the same hams who operated the DX2VOA special event station (commemorating the 50th year of VOA worldwide broadcasting) last February (1992) with Tom W7LUU as the lead operator.

QSL information for 4G2BAG is via the PARA (DU) QSL Bureau, or via DU3DO in the American International Callbook. *[Rene A. Aguinaldo, 4F2IR, Vice President BARONS, 89 T. Bugallon St., Aurora Hill, Baguio City, Philippines 2600.]*

Russia *Short note from Jack UA3RCS:* The Michurinsk Contest Group is issuing the "MCG Medal" for QSOs with MCG members. Contacts after October 1, 1990, are valid. Further information may be received from the Award Manager Anatoly Zheltotrubov, UZ3RV, PO Box 30, Michurinsk, 393740, Russia. A SASE is required. QSL info for R3R, RR3R, RX3ARM, RZ3R and UK1PGO (Franz Josef Land) are via RA3RQT, Andy Yatskiv, at the previous address.

Republic of Slovenia *Letter from Joseph Zelle W8FAZ, translated from Slovenec, September 17, 1992:* In 1964 a primary section of the Sobola Radio Club, Teshanovci, was established. This was the first section among Slovenian villages.

Old-timers like to recall the beginnings and difficulties of the first transmitters. They were helped greatly by Tony Grchar at first. He is credited with founding amateur radio in Slovenia. However, with a few exceptions, activity slowly died away. Then, towards the end of last year, some 30 years later, amateur radio in Teshanovci came alive again.

No one expected such a reaction and so much effort expended by former and present radio amateurs. Last winter, in cooperation with members of the Sobota Radio Club, they successfully developed a course in the elements of amateur radio. The program was intended for local youths and the elementary school of Boginja. The course was successfully completed by 14 youngsters.

During the occasional meetings the members expressed a desire to erect new club headquarters. The original quarters were located in the village's firehouse. Not only were the quarters confining, but the firehouse was located along a busy street. All of this tended to discourage active participation.

With the support of the Sobota RTV Club, the community of Murska Sobota, local groups, and the village board, as well as the unselfish help of numerous villagers and youngsters, last spring they completed the club's new quarters. The quarters are located behind lhe village firehouse.

Within the new addition are the club room, office, work space, and washroom. At least 30 hours of volunteer work went into the project.

Additional information: Since the Republic of Slovenia broke away from the old Jugoslavia, the international call letter prefix has been changed from YU3 to 4N3. *[Joseph Zelle W8FAZ, 24124 Glenbrook Blvd., Euclid OH 44117-1971.]*

NEW ZEALAND

Vaughan N. Henderson ZL1TGC
217 Glenfield Road
Glenfield
Auckland 1310
New Zealand

I am writing to offer my services as a possible *73 Amateur Radio Today* magazine contributor to the "73 International" column for ZL. Des Chapman ZL2VR, the previous contributor, has recently become a Silent Key, and you may be looking for a replacement.

I think I can do the job. Perhaps a little background will help. I have held an amateur radio licence for 22 years. Here in ZL we have had a non-Morse licence called Technician Grade for about 24 years now (what an enlightened country!!), and I have enjoyed operation on VHF/UHF/microwaves/amateur satellites, and contesting, for all that time. Yes—I am finally having a go at passing my 12 wpm and becoming a fully licensed ham!

In my 22 years I have been involved quite extensively with local clubs—I am a life member of one, having had a hand in setting it up (Wellington VHF Group). Since moving to the present QTH some 14 years ago I have been involved as a committee member, secretary, president, and again latterly as a committee member of the Auckland VHF Group.

What is probably more relevant to writing for *73 Magazine* is that I have written the "VHF Column" for the New Zealand National Amateur Radio Association (NZART) magazine *Break-In* for some four years, moved on from that to write the "Amateur Satellite" column for the same magazine for about three years, and lately have been editor and assistant editor of my local club magazine, *Spectrum*, a monthly 22- to 26-page production.

I have also written the occasional article for *Break-In* magazine, most recent of these has been a write-up of the Technology Convention (similar to the USA VHF Conventions), and prior to that articles on repeater sites the Auckland VHF Group have developed in our local area.

My other activity in amateur radio at present is as a member of the 18-member National Executive—similar to an ARRL Director, except we call ourselves Councillors—and as such am very much up with what is happening in the amateur radio scene in New Zealand. Also, I have a good oversight of international amateur radio affairs, especially in IARU Region 3.

So there you have it! If my background and limited writing skills lead you to believe that I could be suitable for the position, I would be pleased to hear from you.

[Needless to say I am deeply saddened to hear of the death of Des Chapman ZL2VR. He gave us so much during the many years of being the 73 Hambassador for New Zealand. After reading several of the articles written by Vaughan I have concluded that he is a very capable writer and I have accepted his offer to become the new Hambassador for New Zealand.—Arnie]

OKINAWA JAPAN

David Cowhig 7J6CBQ
Packet: 7J6CBQ @ JR6RMV.47. JNETR6.JPN.AS

Hello to all from David Cowhig. My new call 7J6CBQ came in June with the help of the JARL International Section in Tokyo. Okinawa, a 70-mile-long string bean shaped island running north-south, lies 300 miles from both Taiwan to the south and the rest of Japan to the north. The one million Okinawans have the world's highest life expectancy—84 years—and today include 120 people age 100 and up. Okinawa, located in a frontier area between China and Japan, was strongly influenced by Chinese culture until it formally became part of Japan in 1872.

Okinawa ham clubs are centered around special interests such as contesting, satellites, DX, and foxhunting. The Radio Society of Okinawa, a predominantly American club which meets at the Kadena USO on the first and third Wednesday of each month, offers US ham license examination sessions every three months. Once a US ham license is in hand, getting a Japanese ticket through reciprocal licensing is easy.

The ham bands are a lot different from the US East Coast. Two meter (144-146 MHz) FM activity is all simplex; a dozen tone access repeaters serve Okinawa hams on the 430-440 MHz amateur band. The long narrow shape of the island makes a yagi a good choice even for general work on 2 meters! Aside from the many new callsigns I hear here, I notice that the HF bands are not as crowded as at home (USA), probably because with the Pacific Ocean to the East and China and Russia to the West, hams are not scattered at convenient distances for HF skip as is the case in North America.

Hams in Taiwan (BV), now numbering over 500, can now work mainland Chinese (BY) hams freely. I had a half-hour chat with Fanny BY3AB in Tianjin today, much more interesting than the hello/goodbye contact I probably would have had working China from my home station in Virginia. Speaking of the Chinese, the lower 500 kHz of 10 meters sounds like the CB band when the skip is in—and almost all the voices are speaking Cantonese! The rapid growth and opening up of China will make China one of the big ham radio countries. Equaling the 1.2 million ham stations and over 1.5 million hams in Japan will take some time, however.

The September 1992 issue of JARL News reports that illegal use of 2 meters by truck drivers has become a very serious problem. On July 1, 1992, a study of 144.00 to 144.48 MHz in the Osaka region found that 17 of the 24 stations operating at 20 kHz intervals in this range were illegal. Illegal stations often appear on ham repeaters in the Tokyo area.

Learning how to work in Japanese on packet radio has been a real thrill. I bought a copy of Japanese language DOS J 5.0/V—a version of IBM PC standard DOS which runs in Japanese on PCs having at least 2 Mb (megabytes) of RAM (random access memory), as well as in English in its US mode—for about $120 [US$ I assume]. Next, I got a copy of WTERM, a free Japanese language modem program. To enter the kana and kanji characters of Japanese you need a front-end processor (FEP). You can either use the FEP which comes with DOS J 5.0V (in which case you will need 4 Mb of RAM) or else a more sophisticated FEP, such as WXII, which sells for about $80. Now I was able to work packet using my PK-232 and use one of the fine Japanese language packet RBBSs on Okinawa. Japanese kanji characters and kana are transmitted using two bytes at a time in order to handle the approximately 6,000 characters in the JIS I and JIS II character sets. Enter the commands AX25 and 8bitconv ON so all eight bits of each byte will get through the TNC (terminal node controller) to your computer.

My packet address, 7J6CBQ@JR6RMV.47.JNETR6.JPN.AS, means that my home BBS (JR6RMV) is in prefecture 47 (Okinawa) which is in turn located in the sixth call area (Kyushu region), in Japan, in Asia. Once I am more settled in I will join some Japanese ham clubs and write another report. As the Ryukyu Broadcasting Company jingle goes, I am enjoying my "sunshine shower in Okinawa."

[I remember my time at Kadena and the rest of the island during the late 1960s. It is a beautiful island and has very nice people. I am sure that David will enjoy himself while he is there. I have sent a letter to him to see if he would consider becoming a 73 Hambassador for Okinawa. I have also sent him a packet message so we will see how reliable that method of communication to Asia is.—Amie]

ASK KABOOM

Number 26 on your Feedback card

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

More Micro Power

Last month, we were exploring the microcontrollers used in modern radios. Let's keep going:

We've discussed most of the functions of a typical micro in a typical rig. Also, we've seen how micros read switches and tuning knobs. But what happens when things don't work? Is it really possible for you to troubleshoot your own digital system, or should you send the radio in for service? Well, it depends on what's wrong, and also on what you feel capable of fixing. If you have a decent oscilloscope and know how to use it, you might have success. If you're armed only with a VOM or DVM and some basic DC circuit knowledge, you'd be smart to find the shipping box; you'd be amazed at how much expensive damage you can do in a few milliseconds' time.

Is It Broken?

Let me state up front that, except in cases of lightning strike or other serious electrical abuse (such as way too much voltage from a malfunctioning voltage regulator), I've almost never seen a micro simply go dead. It can happen, of course, but it sure isn't common. Most of today's micros are made from CMOS, and that's a pretty mature and reliable technology. Those chips can take a lot and keep on computing.

If you've got a rig which doesn't respond properly, be sure the problem really is with the digital section before you start hacking at the micro and its associated circuits. The old computer term GIGO (garbage in, garbage out) definitely applies here. Remember, the micro can only act on the information given to it. For instance, if the radio is jumping frequency or not tuning properly, check the tuning encoder. Is it sending pulses when you turn it? Is it sending any when you don't? (It shouldn't be.) Most tuning encoders are optical, employing a slotted disk between an LED and a photodiode. They tend to be quite reliable, although they do sometimes quit. Don't worry if you can't see any light coming from the LED; most are infrared. Scope the output of the photodiode and see if it jumps when you turn the dial. If not, either the LED is not working, there's no power to it or the photodiode, or the diode is bad. If the pulses are there, check the outputs from the entire encoder. The tuning pulses should be there, and another line should go up or down depending on the direction in which you've turned the knob. If something's missing, you have a problem in the encoder, not the micro. By the way, some encoders use actual switches instead of optical components, and these units are very prone to problems caused by the switches' wearing out and making poor contact. Many walkies use them for the rotary tuning controls, and some HF rigs, such as the Yaesu FT-747GX, use them, too. If the knob has a smooth feel as you turn it, it probably is optical. If it clicks, it may be mechanical.

On the Outs

Output problems may be caused by things other than the digital brains, too. A common problem, especially in rigs with LED and vacuum fluorescent displays, is lack of display or wildly erroneous numbers. Sometimes, random segments may be present. Usually, these problems are not caused by the micro. Let's look at some other causes:

If there's no display at all, check the power to the digits. With LEDs, that's just the line coming from the DC supply, and it probably will be there. With fluorescents, though, it's another matter altogether. Those displays require comparatively high voltages (be careful, please!) and are driven by so-called DC-to-DC converters. The converters actually are little switching power supplies which take the low voltage from the DC supply and step it up to anywhere from 90 to 200 or so volts. In my experience, the vast majority of fluorescent display failures can be attributed to dead DC/DC converters. The usual cause is failure of the switching transistor that drives the step-up transformer.

Most displays are driven by transistors or specialized buffer chips. LEDs only require current buffering, so a bunch of transistors is common. The fluorescents, however, require voltage transformation as well. In other words, the low-voltage driving signals must be changed into high-voltage ones. The special buffer chips which do that are subjected to quite a bit of electrical stress and they are good suspects. Especially if one whole digit, or one segment in all the digits, is out, check that buffer chip. If you can trace the wire for that segment or digit back to the chip's pin, you can use the schematic to figure out which pin is the input for that part of the buffer. It is quite common for just one piece of the buffer chip to open. If the input is there but the segment or digit won't light, you probably need a new chip.

LCDs are a special case. They are driven by low-voltage AC squarewave signals, often directly from the micro or from a special driver chip. There is extremely little current involved, so the chips almost never go bad. Most LCD problems I've seen were caused by bad contact with the displays themselves. LCDs are constructed by sandwiching the liquid crystal material (which you should *never* touch—it's poisonous) between two pieces of glass. On the glass are etched conductive lines to form the segments and their connecting traces. It all comes out to little conductive spots at the edges of the display. Contact with the radio's PC board is made via strips of vertically conductive rubber pressed between the board's contacts and the display's edges. That's why the display is held firmly against the board in a housing of some kind. It takes good, clean contacts and plenty of pressure to ensure good connections. Usually, it all works remarkably well but, sometimes, especially in the prolonged presence of cigarette smoke, the contacts get gummed up and the display malfunctions. If you're careful, you can disassemble it, clean it and get it all back together again. If you've never tried it, though, I recommend doing your first one on something you don't really care about, such as an old calculator, because it's easy to mess it up and ruin the display.

Hey, It Really Is Broken

If the display is messed up, and especially if it shows random segments, you really might have something wrong with the computer. Here's how to tell: If you can still tune the rig despite the display's malfunction, the computer is OK. If the rig won't respond to any of its computer-related controls, chances are that the computer does indeed have a problem.

Like any brain, the computer needs a support system to make it work. First of all, of course, the power supply must be feeding it the correct voltage. A DVM helps here. If the voltage is close, it should be fine. We're not concerned here with 5.1 versus 4.92 volts. But if it is way off, the power supply needs to be fixed before you can do anything else. And, with some micros, supply voltage that's way too high will cause no damage, while with others, it will cause total destruction of the chip. If the supply's too low, the computer won't work but it shouldn't cause any damage.

After power, the next thing a micro needs is a clock. Usually, there's a crystal right next to the chip. Scope both sides of the crystal, using the 10-megohm setting on your probe to avoid loading the circuit down. If either side shows a waveform, the crystal is OK. If they're both dead, either the crystal is bad or the micro is blown. The easiest way to tell is with another crystal. It's not likely you'll have another one of the right frequency, but you can use anything fairly close for a tesL It may not work right, but you'll be able to see if it oscillates.

OK, you've got a clock. That means the crystal is good and the micro is not blown. Notice I didn't say that the micro was good. Usually, if it is not totally blown it will be good, but not always. It is possible for an I/O port or other part of the chip to go bad without taking the entire chip down. It just isn't common.

The final thing a micro needs to work right is a proper reset when the power is turned on. Especially if it is a battery-backed system that maintains data when turned off, there is a sequence that must be followed upon powerup and powerdown. If any element of the reset circuitry fails, the micro may trash the data in its RAM, or it may start up at some unpredictable point in its program, with its registers scrambled. The result is the same: a mess. If the radio has any external reset circuitry, check it out. Usually, there is at least an RC circuit on the reset pin, which holds it up or down for some fraction of a second after power is applied. Check that it is working by scoping the micro's reset pin and turning the power on. Some systems employ multi-chip reset circuits which can be quite difficult to figure out. If you get nothing at all on the micro's reset pin, suspect the reset circuit. If you see a pulse, it probably works. But some micros require several pins to come up in a timed sequence, making troubleshooting next to impossible. Luckily, those kinds of things are more often found in laptop computers than in radios.

The Nervous System

In a simple animal like a walkie, the micro may connect directly to all the inputs and outputs. Or, it may read the keyboard by itself but drive the LCD via another chip. In bigger radios, like full-featured HF rigs, an entire small computer, with many chips, may be lurking behind that front panel. Tackling one of these beasts may not be worth the effort, but that depends on the problem. I remember one rig I had which had no trouble tuning but would not allow mode (USB, CW, etc.) selection. Also, the mode indicators were dead and there was no sound. It turned out that the micro was fine. The problem was in two cheap buffer chips which drove the mode indicator LEDs. The same outputs also set the radio to the various modes. They were dead as the proverbial doornail. They just couldn't handle the current of the LEDs and other circuitry. Finding the trouble was as easy as following the wires back from the LEDs.

Often, though, it's not that simple. Next time, we'll take a look at fixing other digital problems. 'Till then, 73 de KB1UM

NEVER SAY DIE

Continued from page 4

readers and advertisers were fed up with Wayne Green. Well, I couldn't blame them for that . . . though I wondered why the monthly reader surveys kept giving my editorials such high marks.

After about three years IDG threw in the towel. It turned out that the circulation had dropped to less than half and over half of the advertisers had been blown away. The magazine was at death's door. IDG (International Data Group) then entered into a contract with me to run it for them, splitting the profits. I snickered. Profits? To my recollection *73* never in its history ever turned in enough profits for us to be able to buy a bottle of black ink for the accounting department. It just never lost enough money to put me out of business. I published it because I felt it was needed, not to live the life of the rich and famous.

I never quite got the hang of that rich and famous thing . . . probably a poor bringing up or defective genes. I still steal the soap from hotels and go for the sausage, egg and biscuit at McDonald's for breakfast when I'm on the road . . . and that's when I splurge. Normally I bring along my own All-Bran, buy some bananas and milk, and that's my breakfast. I like it, plus I prefer to do what I can to avoid a colon cancer exit from life. It almost got my father, so I'm perhaps overly careful.

Hmmm, I wonder if I'm ever going to get around to what I started out to write. My digressions turn into further digressions. I'd blame it on senility except that I've always been that way. So let's get down to the entree here.

How You Can Help

Having asked readers to try and help me convince advertisers to try *73* in the past and never gotten any response, let's say I've learned from repeated failure not to try that angle. That's too much trouble. One or two letters or calls won't dent the decision-makers who're betting all their ad money on *QST*. Nah, the only way to their black hearts is by facing them with sheer numbers. The fact is that we need more readers. If we could double our paid readership I could sell more ads than *QST* and give you one whale of a fat magazine.

So how can we do that? We're increasing our newsstand coverage substantially, so that'll beef things up a bit. But we need far more than that. I'd like to try a test mailing to the *Callbook* list and see what kind of percentage we'd pull from that. With today's postage costs this is a very expensive project, so the sales have to be much better than usually results from direct mail letters.

It would be nice if you could talk up *73* at your ham club and on the air, but that's asking too much. There is something you can do that'll help me a lot. If you enjoy the magazine, in addition to telling me about it the next time you see me at a hamfest, you can start finding out for me why your friends aren't subscribing . . . and let me know. Oh, I get letters from hams who dropped their subscriptions in 1970 when I was pushing repeaters and have never noticed that I've gone on to other enthusiasms. Others got fed up when I started publishing articles about computers and how they worked back in 1975. Many left during the IDG reign and don't know that testy old Wayne is back.

If you can think of any reason, no matter how ridiculous, why anyone should be reading *73*, please drop me a line. I'm looking for ideas and testimonials. Ask around. We used to run over 200 pages a month and we can do it again if we can get more readers. I'd love to have more room to run some of those long, boring construction articles we used to see so endlessly in *Ham Radio* . . . before they got offed by *CQ*. I know there are probably dozens of you out there who'd welcome them.

"With the recession hitting New England even harder than the rest of the country, everyone was looking for bargains . . . and they were there."

Of course what I'd really enjoy would be us making enough money so we could put on some DXpeditions, complete with contest-winning readers coming along. That would be a ball. It's fantastic fun working the pile-ups. It doesn't cost all that much, so it's something for us to think about. If we could work up a *73* DXpedition, where would you like to go? No, let's not do Baghdad yet. Maybe some place where they're not fighting, though that sure limits our choices these days.

Or perhaps we could organize jump teams to get right into the middle of every civil war in the world, establishing traffic nets to handle health and welfare messages from friends and families in America. We could vie with P.J. O'Rourke in our reports from the hot spots. Did you read his *Holidays In Hell* or *Give War A Chance* yet? Jump teams? I guess I'd better take some parachute lessons, just in case. I've been putting that off, waiting for a good excuse, but now that I'm 70 and have only who knows how many days left, I'd better get at it. I wouldn't want to leave anything like that undone. I think I'll look into these parachutes with small engines on them . . . I understand that no one's been killed yet trying that. Hello CQ air mobile! I think I'd need one heck of a noise-canceling mike.

Reprise . . . please take me seriously about getting more readers. What do you suggest? And no, we tried doing without my editorials and that didn't help. Stop being nasty, just because I give you an opening. Remember, you'll live longer and much happier if you spread joy instead of your everlasting sarcasm and negativeness. You'll also have a happier family.

Boxboro

Not having learned from their past experiences, the Boxboro Hamfest Committee invited me to speak again. The hamfest pulled a great crowd. The place was packed. Too bad if you missed it. Hams poured in from all over New England and even Eastern New York. A whole pack came from my alma mammy, RPI (W2SZ).

Heck, I remember when the W2 area included only Eastern New York. Just west of Schenectady it was the 8th district. That was before WWII. W2 included only Eastern New York and New Jersey then. That's when 160m was one of our most used bands. That and 40m, which was CW only. 20m and 75m both had 100 kc wide phone bands, both packed solid with kilowatt AM stations. Of course it only took nine nets to fill up the band . . . one every 10 kc. 160m was a Class B licensee band, packed mostly with 5- and 10-watt rigs, often 6L6 oscillators modulated by a 6L6. Crystal control, of course. I remember the old Bliley crystals. They cost about $3.50, as I recall. In today's dollarettes that's around $70, so we didn't buy many. We'd check out a frequency for weeks before buying a crystal, making sure there weren't any rock crusher signals on it. Oh, there were some bargain crystals for half the price, but they didn't have the prestige of a Bliley.

We had a booth inside with the commercial exhibits where we did a brisk business in *Radio Fun* subscriptions. This is knocking 'em dead. We also sold a bunch of my *Declare War* books, complete with my signature. Several early buyers of the book came by to tell me how much they enjoyed it and a couple even bought extra copies to give to friends. I encourage that.

The Boxboro Committee was one of the first to stand up to the ARRL Central Committee and insist that I be permitted to talk at an ARRL convention. Heck, for many years *73* wasn't even permitted to exhibit at ARRL conventions, much less have me speak. I think the Boxboro Committee broke their back on that one, giving other hamfest committees the guts to fight HQ and put me on their programs. Most of those HQ old-timers are gone now . . . I've outlived 'em.

Batteries

While I'm reminiscing, I wonder how many of you remember the batteries we used for radios back in the '20s? We had A, B, C, and D cells. The A-cells were also known as bell batteries because they were used in sets of four to power door bells. They were about 2.5" in diameter and around 6" high and provided 1.5 volts. We used two of 'em in our broadcast radios, with a rheostat to drop the voltage to 2.5 volts for the 01As and then later the 56, 57, 58 series tubes. B-batteries had 45 volts and they came in various sizes, all large. C-cells ran 7.5 volts and were used to provide grid bias voltage. They usually had taps at 3.0, 4.5, and 6.0 volts.

D-cells are still with us. Flashlight batteries. Once cathode resistors were invented to develop grid bias, the C-cells were no longer needed. These were around 2.5" by 4" by a half inch, made up of five cells in a tar binder. The larger B-batteries were made up of 30 D-cells wired together. Radios first used 90 volts, then went to 135 volts, and finally to 180 volts, requiring four big (and expensive) B-batteries.

Early radios, the kind I remember from childhood, before the superheterodyne, had big tuning dials on all three amplifier stages. Now I wish I hadn't taken apart all those radios friends gave me to get 'em out of their attics. As soon as they found out I was "interested in radio" I had old sets piling up in my basement.

Late in the '20s B-eliminators began to replace the batteries. These often used BH rectifiers. Later they invented 80s. The early amplifiers had 205H tubes and a big speaker that sat on top of the radio. It was about two feet in diameter and was like putting a big paper cone on an earphone unit.

I lived a block away from the Vitaphone movie studios in Brooklyn and used to find these enormous super heavy duty 45-volt batteries in their garbage. They used to throw them out with lots of juice still left in 'em so as not to take any chances with their cameras running out of power. I had over 2,000 volts to put on a 6L6G from a stack of these batteries. It was okay as long as I didn't hold the key down too long.

Then came 83 rectifiers, 816s, 866 Jrs, and finally those lovely blue 866s. My first big rig had a T-125 in the final. I ran across the sales slip for it from Fort Orange Radio recently. I was able to wipe out every broadcast radio in the freshman dorms at RPI with that rig. They were just fine about it though. The proctors said they had no objection to my operating all I wanted . . . between two and four in the morning. Oh well, that's when the 160m DX was best anyway.

Rotten Wayne Green

Now and then I get a really nasty letter from a reader who's mad about something. At first I considered being upset by these letters, but after some thought I realized that the only real measure of the success of my ideas lies in the quality of my naysayers. If I start hearing from intelligent complainers then I'll know I've got a problem. In the meanwhile I'll continue to enjoy the reason-challenged complaints.

For instance, there's the wonderful brouhaha over gay hams. I got a real hoot when I wrote something sarcastic about those who get their bowels in an uproar one way or the other about gays. So *Monitoring Times* reprinted some of my comments out of context, thus apparently trying to make me appear anti-gay. This triggered a letter from a gay militant who took *MT* seriously and believed what he read. For the record, before I ran into the (censored) gay chap running Lambda and his self-promoting frivolous lawsuit against the ARRL, I was neither pro- nor anti-gay. In the light of his fanaticism I may have to re-evaluate my position. I do know that I am so anti-lawyer that any ham or ham group that stoops to suing goes right to the head of my fecal list.

I Get Complaints

Then, while I'm generally swamped with compliments on my hamfest and convention talks, I got a note from someone bitching that I used the opportunity to promote my stuff. You bet I do! I didn't know I ever made any beans about that. I promote *73*. I promote *Radio Fun*. I promote my new book, *Declare War*. I promote my CDs and music publications. If I had any other businesses I'd promote them too. But I plead guilty with an explanation.

You see, as I've explained before, none of these enterprises are aimed at making loads of money. I can't let them lose too much, but each was started because I saw something that I felt needed to be done.

One of the goals of *Declare War* is to help fix our terrible educational system. And a big part of that fix has to do with getting our kids to take an eight-year course in the fundamentals of electronics, communications and computers. This is the only way I see for us to have a chance at generating millions of new hams . . . millions of kids interested in technology . . . so we'll have the high-tech career engineers, scientists and technicians we must have if America is ever going to regain its consumer electronics industries. If I thought for a minute that this goal was beyond hope I'd fold my ham magazines and petition the FCC to close down our ham bands as a waste of valuable frequencies.

So yes, you bet I'm pushing my book at hamfests. I'm pushing it on every radio interview I can, at every service club meeting and so on. I want to see millions of youngsters coming into amateur radio. From there my *Radio Fun* will get them to have fun with packet, satellites, transmitter hunts, DXing and so on. Then, with *73*, we'll go on to encourage them to build gadgets, to start experimenting and pioneering new modes of communications.

Sure, I talk about my music businesses. I happen to think that the hams who have no other interests are wasting their lives. They should be interested in music, in art, poetry, reading, photography, and other things. They should be out with me skiing in Aspen in January. They should be down in the Caribbean skin diving, with or without me. They should be learning to fly, trying out ultralights, parachuting, climbing mountains, bicycling, and so on. We don't need a bunch of monomaniacal dweebs making us look like jerks.

I've got to take some time and get used to these rollerblades I bought. And I really have to get out and bicycle around New Hampshire . . . try sky diving . . . see how good the white water rafting is up here, and so on. Well, I just bought a couple of bicycles, so we'll see.

Poverty Sucks

I'm also a real pest when it comes to hams not having money. There just isn't any good excuse for this other than a lack of motivation. There's tons of money to be made. There are unlimited opportunities. There is just no good reason for anyone to be short of money. And hams have a gilt-edged license to make money if they do anything more than waste their time by merely memorizing the Q&A to get their ticket. We see far too many seven- and eight-year-old hams who've gone on to Extra class and understand the technology for anyone to have a good excuse for not taking advantage of the hobby to learn about electronics and communications. That's just pure laziness.

When I run into old-time hams who are bewildered by transistors and antennas, I have little respect for them. When I ask for a show of hands at my talks and I see one lonely hand go up when I ask how many there have gone on DXpeditions, I cringe. How many are making contacts via our satellites? Three hands. Ugh. How many have worked over 300 countries? One hand. How many are on packet or RTTY? Six hands. Jeeze. How many have helped a newcomer get a ticket in the last six months? Four hands.

There are an almost unlimited number of ways to capitalize on electronic skills. There are tons of VCRs, TVs, computers, hi-fis and so on which need repairs. Then there's the fast-expanding security business. Millions of homes, apartments, offices and warehouses need security systems. I've worked in radio and TV stations, in a radar research lab, manufactured loudspeakers, and so on. I've manufactured field strength and power meters. I've put together and sold thousands of parts kits. I've built special radios for receiving WWV/CHU time signals for rallyists. Only your imagination will limit your success.

Declare War

My book describes fairly simple so-

lutions to most of our major political problems, but if the general public doesn't do anything about the opportunities they have to make big changes in Congress, the federal and state governments, welfare, crime, prisons and so on, our country is going to continue to sink and we're frittering away everything we fought for in our wars . . . everything people came to this country to find. Then I see how few hams are taking advantage of the enormous opportunities they have to learn and be of value and I get discouraged. Should I just give up and learn to play golf so I can take out my frustrations on golf balls?

I've been writing about how the mind works . . . the first time I think this information has been in print. With some encouragement I'll continue and explain how to repair the mind. That's going to be a lot of work to write, so I'm not going to spend my time unless I get a whole lot of encouragement. A couple dozen letters aren't going to do it. But perhaps you'd rather I just write more about the messes we have on our bands and stick to amateur radio.

Yes, I know how to fix a great many of people's phobias, compulsions, and even some major medical problems. Yes, I can explain exactly how to tackle these things so that almost anyone can do it. Is this Wayne Green baloney and exaggeration? Check back over my 40 years of writing editorials and let me know when I've ever made claims I couldn't back up. Ever.

I do my homework. That's why I'm able to get up in front of a large group and talk with confidence. I have to know more about what I'm talking about than anyone in my audience or I'm going to be in trouble.

The Universal Hobby

Speaking of messes, I'm about to do an about-face on the 14.313 garbage heap. Instead of rubbing the League's nose in the mess they've encouraged and abetted, I'm coming around to a new concept. We want amateur radio to have something for everyone, right? So why shouldn't we set aside one special frequency for our psychopaths and mentally-impaired to have free rein? Every time we run into a brain-challenged ham let's encourage him to move to 14.313 and have at it. If that gets too full, then we've always got 14.275 as a back-up sewer. Let's figuratively flush our amateur toilet on these two frequencies, since nothing we can do will make them stink worse than KV4FZ and K1MAN already have.

I hope I get some good answers to my request for suggestions for setting up my station with a whopping signal. I've been listening to Rush Limbaugh recently and I think I can pontificate right up there with him and even at equal length. The only big difference is that instead of knowing I'm right about everything, I know there's more to learn. All I can do is pass along what I've been able to learn. That's the one main difference between religion and science . . . scientists continually have to admit that they're wrong as new data emerges. Religions are never wrong, no matter how much evidence there is to the contrary.

Will our religions last another hundred years? Probably . . . but time could be running out on some of them. If we're actually able to improve our educational system it's going to make things far more difficult for fundamentalist religions.

December 1942

It was 50 years ago that I joined the Navy. My hamming came to an abrupt halt on December 7th, 1941. I'd just won the Eastern New York section award for the Sweepstakes contest and was having a ball. A special close-out on classical records by Radio, Wire, Television . . . later to become Lafayette Radio . . . had gotten me off on a classical music kick. That stood me in good stead in 1952 when I went into the speaker manufacturing business . . . and again in 1984 when I started publishing a music magazine.

I tried volunteering for the Army Air Corps, but they didn't want anyone with asthma. I was allergic to almost everything, having inherited plant allergies from my mother's mother and animal allergies from my father. Came hay fever season and I was a mess.

Then Tom Jones, who'd worked for my father with American Export (transatlantic) Airlines and had rejoined the Navy as a Lt. Commander when the war started, put me in touch with Commander Bourne, who was running the Naval Research Lab at Anacostia, just across the river from Washington. I took the train down for an interview. He wanted me for his lab, but first I'd have to go through radar school. Radar was then top secret, so there was no other way to learn about it.

I went home to Brooklyn, packed my bag, returned to Washington and joined the Navy. They sent me to the Washington Navy Yard where, since

they were out of uniforms, they gave me three-week's leave. This luckily allowed me to be with my folks for Christmas.

The Gypsy's Prophesy

One odd thing happened during this time. My grandmother and I were in New York doing some Christmas shopping. We stopped off at a gypsy tea room for lunch. The lunch naturally included a tea leaf reading. The gypsy looked at my tea leaves and then at me. She was puzzled. She said it looked as If I was in the military, but for some reason wasn't in uniform. This wasn't normally legal, so it was very unusual. I nodded impassively. She then went on to say that someone with the initials TJ had recently had a big influence on my life. She said she saw me in a very large building and that in some way I would come out on top. She didn't know what that meant, but that was what she saw.

The large building turned out to be the Bliss Electrical School In Tacoma Park, Maryland, where I spent the first three months of my Naval electronics schooling. Being a ham, this was duck soup for me. I loved every minute of it and graduated number two in my class, but only by a hundredth of a point margin. At the time I was disappointed because if I'd been number one I'd have had an option of taking the advanced course in Washington instead of Treasure Island, in San Francisco. And that, in turn, would have undoubtedly eliminated my deciding to go to sea on a submarine instead of the research lab.

Commander Boume said to let him know when I was graduating from radar school so he could cut orders to bring me back to his lab. The course at the Radio Materiel School on T.I. lasted six months. It was superb. It's amazing how much you can learn when you work at it all day every day. I did well there and earned my Radio Technician second class stripes on graduation.

Land Or Sea?

Then I was faced with a big decision. Should I call Bourne or go to sea? I figured that a research job probably would be better for someone who was married and would be missed more than I, so I decided to go to sea. In retrospect I probably would have been more valuable to the war effort if I'd gone back to the lab. Even at sea I was busy designing and building radar target alarms, setting up a remote radar screen in my bunk, testing out a new underwater sound system concept, and so on. I turned the radio room Into a research lab when I wasn't on watch or sleeping.

Once I'd decided on going to sea I wanted to pick a ship where I'd be in charge. I don't do well taking orders, so that was the best approach. I found this meant either a destroyer or a submarine. Knowing that submarine pay and food is better, I opted for that. Besides, I liked the concept of either coming out intact or not coming out. You don't stand much of a chance of losing an arm or a leg, just your life . . . and you know kids of 20 think they're indestructible.

So I volunteered for submarine duty. This meant taking a physical exam. Big deal. I reported to the infirmary for the exam. While I was waiting with a bunch of others I noticed them memorizing the eye chart, just in case. My eyes were much better than most people's . . . I could read signs two blocks away and read microscopic print . . . so I wasn't worried, but having nothing better to do I memorized the chart too. I still know it forward and backward . . . DEFPOTEC and CETOPFED. I can read it with my eyes closed.

Disqualified!

When my turn came the doctor looked at me and said I was rejected. Huh? He said I was overweight. How much am I overweight? He tried to get me to leave, but I insisted, so he looked it up. Eight pounds. Hmmm. Okay, today's Friday, if I come back Monday eight pounds lighter, will you accept me then? Sure.

When I reported back to the school they asked if I'd passed my physical. I said I had to go back again Monday. I spent much of the weekend on the obstacle course. I didn't eat or drink anything. I went into San Francisco and spent about three hours in a steam bath, sweating as much water out of my system as I could.

On Monday morning I reported back to the infirmary. They weighed me and found me 10 pounds lighter. Wow, I'd made it. Almost. The doctor looked at me again for a moment and said I was still disqualified . . . flat feet. Now what in hell do flat feet have to do with submarine duty? I was furious and I staggered back to the school, weak from hunger, thirst and a weekend of endless exercise.

The school yeoman asked me if I'd passed the physical. I said sure and rejoined my class. Wouldn't you know they were in the middle of a strength test at the time . . . and I could barely stand up. Even so I did well chinning myself and got a good score for the tests.

Later, when we were being particularly nastily depth charged, I'd go back to the yeoman's file on my submarine and admire my medical record with the big red stamp on the front, "Disqualified for Submarine Duty."

When we were graduating from the school they gave us an opportunity to sign up for $10,000 in life insurance. Who needs that, I laughed. After my first war patrol I decided that the Japanese were really serious about killing us. In fact they'd come much too close a few times. So I applied for the insurance.

Two war patrols later I got a letter saying that the doctor had missed filling in one of the blanks on the application so I had no insurance yet. Having survived a whole lot more depth charging, strafing, and bombs being dropped on us (and missing), I said to hell with their miserable insurance. When we had some very close calls and none of us were at all sure we

were going to make it, I thought perhaps I'd made a mistake in passing up the insurance.

Actually the insurance was a pretty good deal, so I finally signed up for it the day they mustered me out a couple years later.

Reunions

My old *Drum* crew gets together every year for a reunion. At first I put off going because I really didn't want to see all those kids I lived and worked with 30 years before as old men. None of us like to come to grips with the fact that we're getting old and this would force me to face it. After a couple of years I started attending reunions. By then many of my old shipmates were already dead. The smokers, mostly.

I go every year or two, getting together with fewer and fewer each year as my old buddies die off. We meet in Mobile, where our old boat is tied up next to the *Alabama* in Battleship Park. If you're ever down there please stop and visit the *Drum* SS-228 and see where I spent most of the war. You'll also have a chance to read the early "*Drum* Newsletters" I put out, complete with some great stories of the things that happened to us. They're framed and hanging on the bulkheads. I was the only one on the boat with a camera, so I had tons of pictures for the newsletter. I even had my own developing tank so I could process my film anywhere we stopped for a refit and rest camp between war patrols.

A lot of people aren't comfortable in submarines. It's a poor place for claustrophobics. It's even a bad place for nervous people, particularly during a serious depth charge attack. It's hot . . . often running 150° or more. You don't dare make the slightest noise and you can hear the screws of the ships above you as they drop their depth charges.

Well, so much for 50 years ago. Oh yes, that summer, before I joined the Navy, I worked at G.E. in Schenectady in Building 89, testing and aligning radio transmitters for the Army. Oldtimers will remember the BC-191. It as designed in 1935 and was a huge clunker with a series of seven plug-in tuning units, each the size of a bread box and the weight of a cinder brick. This rig was so crummy it wasn't even worth converting for ham use after the war. It was supposed to be used for command cars and trucks.

The command-set SCR-274N transmitters (and receivers) were a fraction of the size and weight, were far more stable, and put out as much power. These were converted for ham use by the zillions. I enjoyed converting the BC-459s and used one drive my pp-813 kilowatt amplifier when I got into working DX.

Maybe next year I'll write about 1943. Maybe not. ■

UPDATES

Number 31 on your Feedback card

Packet on the Mac
(Update on Last Month's Update)

Refer to the above article on page 8 of the October 1992 issue. The update of the parts placement diagram (see Figure 2 in the November '92 *Updates* section) is incorrect due to a printing error. The overlay was inadvertantly shifted down in last month's diagram. See Figure 1 in this column for the correct parts placement diagram. ■

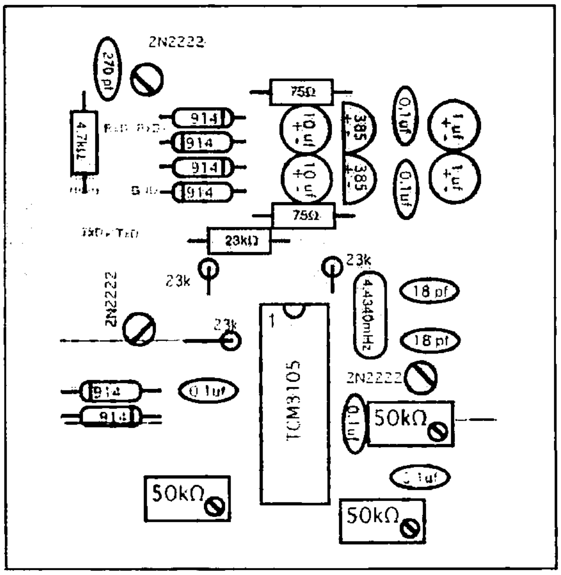


Figure 1. The corrected parts placement diagram of the PacketMac Modem showing the jumper wires as well as the new pad assignments (shown in red). Using these new pad assignments, just follow the wiring hookup chart in Figure 4 in the original article for the proper connections.

Number 27 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events** in **FILE Area #11** on our **BBS (603-924-9343)**. for listings that were too late to get into publication.*

DEC 5

ALAMAGORDO, NM The Alamogordo ARC will sponsor VE test sessions beginning at 12 noon. Persons already holding an Amateur license and wishing to upgrade, must bring their original license and CSCE (if any) and a copy of both. Contact ***Ole WA5IPS, (505) 437-5896*** or ***Larry WA5UNO, (505) 437-0145*** for info. Talk-in on 146.80 -600.

MESA, AZ The Superstition ARC, WB7TJD, will sponsor this year's Hamfest at Mesa Community College, Dobson Rd., between SR360 and Southern Ave., SW campus corner, 7 AM-2 PM. Tailgating. Admission: Commercial $10, Sellers $5, Buyers $2 per car. Talk-in: WB7TJD 147.120 +600; 146.84 -600. Contact ***Bill Howes KG7XB, 718 N. 94th St., Mesa AZ 85207. Tel. (602) 380-4839***, or write to: ***SARC, P.O. Box 1551, Apache Junction AZ 85217.***

DEC 12

HUNTINGTON, WV The Tri-State ARA, Inc., will sponsor W5YI VE Exams at Our Lady of Fatima church school class rooms, 545 Norway Ave. No pre-registration necessary. Please bring a photo ID, copy of current licenses or original CSCE, and a completed Form 610 (Form 610 will be available at the session). Please arrive by 9:15 AM in order to register and have ID and Form 610 checked prior to examination. For info call ***Jim Baker K8KVX, (304) 736-6542.***

DEC 20

MILFORD, CT The Fowler Bldg., 145 Bridgeport Ave., will be the site for VE Exams sponsored by the Coastline Amateur ARA. All classes. Begins at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125***, or ***Dick WA1YQE, (203) 874-1014.***

JAN 10

MILWAUKEE, WI The 21st annual Midwinter Swapfest will be sponsored by the West Allis RAC at the Waukesha Co. Expo Center Forum from 8 AM-2 PM. Directions: I-94 to Co. J, south to FT, west to Expo. Advance tickets $3; $4 at the door. Table space: First 4' $3 in advance; $4 at the door. Additional 4' $4 in advance, $5 at the door; electrical outlet $5 if available. Advance reservation deadline Dec 31, 1992. VE Exams given at Red Carpet Lanes (across the street) starting at 9 AM. Write with SASE to ***WARAC Swapfest, P.O. Box 1072, Milwaukee WI 53201.***

SPECIAL EVENT STATIONS

DEC 12

BROOKHAVEN, MS The Southwest MS ARC will operate NM5Z from 1400Z-2400Z to celebrate 175 years of statehood and Mississippi Homecoming. Operation will be in the lower General portion of 40, 20 and 15m phone subbands, and the Novice 10m phone subband. For QSL, send your QSL and SASE to ***Mississippi Homecoming, c/o David Pickard NM5Z, Route 4, Box 386, McComb MS 39648.***

DEC 19

PERRIS, CA The Hams of the Orange Empire Railway Museum will operate KC6TKT and other calls 1900Z-2359Z to celebrate their annual North Pole Limited Steam Train operation. Frequency: SSB 28.340 MHz. For QSL, send QSL and #9 SASE to ***OERM, P.O. Box 548, Perris CA 92572-0548.***

DEC 19-20

NORTH POLE, AK The North Pole Hamsters ARC will operate Station WL7CX from the home of Santa Claus. Operation will be on 20m and the Novice portion of 10m. Send QSL and SASE to ***N.P. Hamsters ARC, P.O. Box 56424, North Pole AK 99705.***

DEC 23-24

SMITHFIELD, NC Triangle East ARA will operate N4SXG from 1300Z-2300Z to commemorate the 70th anniversary of the birth of the late Ava Gardner. Frequencies: CW—3.715 and 7.135; PHONE—14.260 and 28.335. For certificate or card, send QSL and appropriate SASE to ***TEARA, 209 N. Third St., Smithfield NC 27577.***

DEC 30-JAN 1

PASADENA, CA The Relay Repeater Club will operate Station KF6UF, 1600Z-0200Z each day, Dec. 30-Jan 1, from the Wrigley Mansion, to commemorate the 104th anniversary of the Tournament of Roses—104 years of the Rose Parade and 79 years of the Rose Bowl Game. Primary frequency will be 28.460 MHz. Secondary frequencies will be 21.335 MHz and 14.260 MHz. Amateurs in California/Nevada can contact the station on the half hour, on 2m, through the 147.21+ rptr., or on the hour on 220 MHz, via the Condor Connection. For a certificate, please send a QSL with Contact Number and a 9 x 12 SASE with 58 cents postage to ***Relay Repeater Club, P.O. Box 81, Arcadia CA 91066-0081.***

JAN 2-3 and JAN 9-10

FLEN, SWEDEN The 22nd annual Hunting Lions in the Air Contest, sponsored by the Int'l. Assn. of Lions Clubs, and coordinated by the Lions Club Flen (Sweden), will be active on CW from 0900 UTC Sat. Jan 2-2100 UTC Sun. Jan. 3. SSB will be active 0900 UTC Sat. Jan 9-2100 UTC Sun. Jan 10. For rules and info, please write to: ***Contest Committee, Lions Club Flen, Box 106, 642 23 Flen, Sweden.*** All logs must be mailed by Feb. 15, 1993.

Number 28 on your Feedback card

BARTER & BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the January classified ad section is November 12, 1992.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. Affordable Electronic Repair, 7110 East Thomas Rd., Scottsdale AZ 85251. (602) 945-3908. BNB220

GIVE THE GIFT OF MUSIC THIS HOLIDAY SEASON. THE RYTHM OF THE CODE Morse Code Music. See ad index to locate our display ad. Kawa Productions, PO Box 319, Weymouth MA 02188. BNB221

FINALLY HEAR those unreadable signals buried in noise, heterodynes, tuner uppers. The **REVOLUTIONARY** new JPS audio filter NIR-10, digital signal processing, simple hook up, deep discounted $329.95 delivered! Authorized dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR. Orders: (800) 484-4002, code 1356. BNB254

THE MOST COMPLETE AND COMPREHENSIVE RESISTOR COLOR CODE IDENTIFICATION CHART/COIL WINDING DATA CHART/L, C, F NOMAGRAPH. Is your resister identification getting rusty? Don't waste time looking for that old basic electronics book. Have this handy chart posted above your work bench. Chart includes these hard to Interpret 5-band precision resistors, includes all known tolerance colors too! Included with the resisor chart is a handy coil winding data chart for RF coil windings. For those who hate lo do math calculations, if you know any two of your L, C, or F, you can find the other instantly with lhis handy **L, C, F Nomagraph!** Send $3.00 to **TMS ELECTRO DATA INC.,** 4906 S.E. Mills, Lawton OK 73501. BNB255

QRP KITS IN CANADA! CW Transceivers, Receivers, Morse Keys, and more. Details: "CQ RADIO KITS," Box 1546, Bradford, Ontario. L3Z-2B8 CANADA. (416)-775-9119. BNB433

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COAX, GROUND RADIAL WIRE, lowest cost, top quality, MilSpec RG-213, $.38/ft.; RG-8X, $.19; RG-58, $.18; LOW LOSS Belden equiv. RG-9913, $.39; any lengths plus shipping. Radial wire #16, $39.50/1000 ft. includes shipping! Immediate shipment. Catalog, $1.00. DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB562

RIG REPAIR by 20-year ham. Fast, reasonable. Skip Withrow, 5404 S. Walden Street, Aurora CO 80015. (303) 693-0997. BNB702

IBM PC VIDEO DIGITIZER 640 BY 480 RESOLUTION. 256 gray levels, $89.98. Demo disk, $3. Information, $1. Colorburst, Box 3091, Nashua NH 03061. BNB703

ROSS' $$$$ NEW December (ONLY): KENWOOD TS-450S SPHONE, TH-78A SPHONE, TM-241A $355.00, TS-711A $1000.00, MFJ 815B $52.00, 949E $134.90, 311 $40.00, HEATHKIT HW2P $239.99, HW24HT $299.90, HK232A $230.00, TELEX HYGAIN CD-45II $240.00, 372-S $419.90, 500 FT RG-213 $150.00, YAESU FT-470 $470.00, FT-703RTT $259.90, SC-1 $139.99. YR-901 $499.99. ALL LIMITED TIME OFFERS. OVER 9,037 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB707

GIANT SOLAR PANELS $44.00 EAI Excellent Prices/Solar Equipment/Accessories. Free Information/Send Stamped Envelope, Catalog $3.00. To: Quad Energy, P.O. Box 690073, Houston TX 77269. (713) 893-0313. BNB715

SIMPLEX REPEATERS $149.00! We manufacture them ourselves. Quad Energy. (713) 893-0313. BNB716

ELECTRON TUBES: All types and sizes. Transmitting, receiving, microwave . . . Large inventory = same day shipping. Daily Electronics, 10914 NE 39th ST. Suite B-6, Vancouver, WA 98682. (800) 346-6667 or (206) 896-8856. BNB719

WE HAVE IT! AEA, Astron, Bencher, Butternut, Callbook, Comet, Diamond, Hustler, Kantronics, Larsen Antennas, MFJ, Radio Shack, Smiley, antennas, Valor antennas, and more. Small town service with discount prices. Dandys, 120 N. Washington, Wellington KS 67152. (316) 326-6314. BNB722

MINIATURE POLICE RADAR TRANSMITTER one mile range, $41 assembled, $31.00 kit, (219) 489-1711. P.O. Box 80096, Fort Wayne IN 46898. BNB725

BUILD YOUR OWN WIRE ANTENNAS, parts, GROUND RADIAL WIRE, open-wire feedlines, copper-weld, insulators, coax, Dacron rope, baluns, etc., LOWEST PRICES. Catalog, $1.00, DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB726

HAM RADIO REPAIR—Prompt service. ROBERT HALL ELECTRONICS, 1660 McKee Rd., Suite A, San Jose CA 95116. (408) 729-8200. BNB751

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AMIGA, MACINTOSH, ATARI, ST/XL/XE Amateur Radio and electronics PD software, $4.00 per disk. Send 2 stamp SASE for catalog. Specify which computer! KD-ware, Box 1646, Orange Park FL 32067-1646. BNB757

LOWEST PRICES ON RAMSEY KITS AND ASTRON POWER SUPPLIES. Send SASE for price list. INTERNATIONAL PRODUCTS, INC., 5083-A Jonestown Rd. Suite 441-7312, Harrisburg PA 17112. BNB759

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ELIMINATE MULTIPLE NOISE TONES in your receiver audio output. The revolutionary new JPS notch filter, model #NF-60, Digital Signal Processing simple hook up. Unlike other Notch Filters, notches out multiple varying tones. **Deep Discounted:** $139.50 delivered continental U.S.! (Elsewhere $150.00 plus shipping.) Authorized JPS dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR orders: (800) 484-4002, code 1356. BNB763

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PRINTED CURCUIT BOARDS for projects in *73, Ham Radio, QST, ARRL Handbook.* List SASE. FAR Circuits, 18N640 Field Ct., Dundee IL 60118. BNB966

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	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A.	72,737	75,779
B. 1.	17,259	15,117
2.	29,310	29,054
C.	46,569	44,171
D.	754	751
E.	47,323	44,922
F. 1.	1,990	1,689
2.	23,424	29,168
G.	72,737	75,779

I certify that the statements made by me above are correct and complete

Publisher

PS Form 3526,

Number 29 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

There was an amateur radio industry meeting at the National Convention in Los Angeles a few months ago. I don't generally go to these meetings, but I happened to be free at meeting time so I went. One of the main topics of discussion was: Now that we've had a nice upswing in the number of new licensees, the ham industry should take some responsibility in keeping these newcomers involved in the hobby.

One of my esteemed colleagues in the publishing field went on at some length, stressing the point that the industry hasn't done *anything* to help the newcomer, and that we ought to, as a group, be doing something. I was so astounded at this statement that I didn't open my mouth, but I will now.

I have a question for the entire amateur radio industry: What the hell do you think *Radio Fun* is? Wayne Green Incorporated has invested thousands and thousands of dollars in the starting and continuation of *Radio Fun*. We go to great pains to make sure that every single new licensee gets a couple of free issues of *Radio Fun* as sort of a "welcome to amateur radio." Do you know how much it costs to produce and mail over 10,000 tree issues of *Radio Fun* every month? We work long and hard, trying to develop editorial features and columns that are specifically of interest to newcomers. For almost two years, the staff of *73* have been putting in extra time and effort to produce *Radio Fun*, and not one—NOT ONE—employee has received one penny in extra compensation. We haven't hired any new staff to take care of the added work load, either.

Am I telling you all this to get your sympathy? No! *Radio Fun* is a business, and we're sure that eventually it will be profitable. Business start-ups are risky any time, and in the middle of a recession they are almost insane. (I tried that argument with Wayne two years ago. He told me to get *Radio Fun* started anyway.) Yes, we started *Radio Fun* in order to help the newcomers, but none of you are so thick as to believe we didn't hope to eventually make a profit. Find a need and fill it. That's the American way.

73 isn't (and never has been) part of the ham radio industry clique. There was a time when we weren't allowed to exhibit at ARRL conventions. When we finally were allowed to exhibit, we were usually given booth space in the back corner of the exhibit hall. Even though those days are over, we continue to pay the price for past and present boat rocking. That's OK. It's the price you pay for speaking your mind, and for assuming that ham radio operators have enough intelligence to deal with tough issues and make up their own minds. Fine. We'll deal with the narrow-minded sheep who hang up on our ad reps or who send Wayne unsigned hate mail. We can deal with certain publications whose writers take pot shots at us, while hiding behind pen names. Those folks wouldn't know an original thought or a good idea if it bit them on the ass (and their publications are a joke, anyway). All of this, and much more, are part of the package when you work for Wayne, but for the ham radio industry, because of petty jealousy, to simply ignore (and in a few cases, to back out of signed advertising agreements) the fact that *Radio Fun* exists is ludicrous.

I would like to remind the ham industry that one company—the company that brings you *73—has* done something to help keep the newcomers involved. *Radio Fun* is the only publication that guarantees exposure to the entire population of ham radio beginners. Just because a small vocal minority of League-brainwashed companies have some unspecified problem with Wayne Green doesn't change the fact that he is the *only* one of you who has put his money where his mouth is when it comes to helping the newcomers.

I'll clue you into another fascinating fact: The 25,000+ monthly readers of *Radio Fun* love it. Since we started *Radio Fun* we have received exactly three—THREE—complaint cancellations. Our renewal rate after the first year is astounding. Except for the occasional late mailing or ripped magazine, we have received absolutely no complaints about the magazine's content. We get buckets of mail from newcomers who thank us for providing a publication for them. I have actually had people—dozens of them—walk up to me at shows and thank me for *Radio Fun*. They are thanking me for something they are paying for! It's amazing.

And yet, the ham radio industry has the nerve to sit around and complain that nothing is being done for the newcomer. Give me a break, guys! *Radio Fun* is there, and it has been for close to two years. It will be there two years from now, too. It reaches an audience that nobody else is reaching, for a fraction of the cost of any other advertising method. In fact, we are currently working on a program that will make it possible for just about any company to advertise in *Radio Fun* for such a low rate that it totally negates the old "we can't afford to advertise" complaint. In fact, certain types of products won't pay anything.

I don't mind taking heat for Wayne and his outspoken views. I don't mind the occasional snub we get from some of the less-enlightened in our industry (though, taking out their 20-year-old anger at Wayne on his employees seems a bit dumb). I can accept that there are those who, out of spite and jealousy, are willing to pass up the opportunity to make money (I don't understand it, but I can accept it). What I can't accept is a small minority of know-it-alls who choose to ignore the fact that *Radio Fun* exists—that it's *another* good idea from the fertile mind of Wayne Green—and, most importantly, that the folks listed on the masthead of this magazine work their butts off to give the ham industry the opportunity to reach a lucrative new audience.

You guys can choose to ignore our efforts if you want. If you don't see the business sense of advertising in *Radio Fun* then there's not much we can do for you (though I can't fathom why a company would not want to reach the newcomers). Let's just not forget that when you were sitting around complaining that nothing was being done, Wayne Green and his Team had already been hard at work for almost two years. 73

Number 30 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

December "conditions" are expected to be very interesting astronomically as well as ionospherically. Beginning on December 23rd and extending to December 24th, there will be a PARTIAL ECLIPSE OF THE SUN sun visible in eastern China, Korea, Japan, extreme eastern Siberia, and southwestern Alaska. On December 9th-10th there will be a TOTAL ECLIPSE OF THE MOON visible in Asia, Europe and Britain, Africa, Iceland, Greenland, S. America (except southernmost), Central America, and North America (except the West Coast).

December will bring excellent HF openings on Good (G) days during the month with DX during daylight hours into most parts of the world—moving westward with the sun. The higher HF bands will close earlier than in summer, but you can expect good short-skip openings also during the daytime. The bands above 30 meters will close by dark or a little after. The HF bands from 30 meters down through 160 will become increasingly DX-active during the late afternoon and evening hours, and will continue to provide openings around the world until after dawn. Short skip from coast to coast will also be available during the nighttime hours on most of the lower HF bands. In general, the lower the frequency, the later the bands will open for DX, with 30 meters opening in mid-afternoon followed by 40 meters and finally 80 and 160 meters in the early evening hours.

Be sure to use grey-line propagation, too, which follows the paths of sunrise and sunset around the world. Long path openings may also be expected in early morning hours as well, so December should offer some good DX opportunities.

The charts show which day ought to be Good (G) Fair (F) or Poor (P). The poor days will be centered around December 4th and I think you will find the days surrounding this date to be very "interesting" in a geophysical sense. Be particularly alert for solar disturbances, and magnetic field storms on earth. Also, around the 15th and 19th there are likely to be unusual propagation conditions.

By now, almost everyone realizes that the solar flux values have been low for the past several months, coincident with declining sunspot numbers. The peak activity of Cycle 22 was during August 1989, so the minimum is likely to occur in 1995 or 1996 . . . perhaps sooner! Recent studies seem to point toward an apparent "cycle" of 22 years—with two peaks and two minima.

Did you notice that I was clearly WRONG about October's predicted POOR days on the 5th and 6th? These were great days for propagation . . . As I write, the predicted Poor conditions for October around the 9th, the 17th and 20th, and again on the 30th and 31st, haven't occurred, so maybe I'll be vindicated. We'll just wait and see. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	20	20	-		-	15
ARGENTINA	20	40	40	40	-	-	20	15	15	10	10	15
AUSTRALIA	15	20	20	-	40	40	40	-		20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40*	40*	-	20	15	10	15	20	20	-
HAWAII	15	20	-	-	-	-	20	20	20	10	10	15
INDIA	-	-	-	-	-		20	20	-	-	-	-
JAPAN	15	20	-	-	-	-	20	20	-	-	-	15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
SOUTH AFRICA	20	40*	-	-	-	-	20	10	10	10	15	20
U.S.S.R	-	-	-	-	-	-	20	15	20	20	-	-
WEST COAST	15/20	20/40	80	160	160	160	-	-	-	10	10	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	-	-	20	-	-	-	15
ARGENTINA	20	20	20	40	40	-	20	20	15	10	15	15
AUSTRALIA	15	20	20	-	-	-	40	-	-	-	15	10
CANAL ZONE	15	20	40	40*	40*	-	20	15	10	10	10	15
ENGLAND	40	40	80	-	-	-	-	20	15	15	20	40
HAWAII	15	20	-	40	40	40*	40*	20	20	15	10	15
INDIA	-	-	-	-	-	-	-	20	-	-	-	-
JAPAN	15	-	-	-	-	-	-	20	-	-	-	15
MEXICO	15	20	40	40*	40*	-	20	15	10	10	10	15
PHILIPPINES	15	20	-	-	-	-	-	20	-	-	-	15
PUERTO RICO	15	20	40	40*	40*	-	20	15	10	10	10	15
SOUTH AFRICA	20	40	-	-	-	-	-	15	10	10	15	20
U.S.S.R.	-	-	-	-	-	-	-	20	15	20	-	-

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	-	-	-	40	40	40	-	-	20
ARGENTINA	15	20	-	40	40		-	20	-	10	10	15
AUSTRALIA	10	15	20	20	-	-	40*	40*	20	20	15	15
CANAL ZONE	15	20	20		-	-	-	20	15	10	10	10
ENGLAND	20	40	40	-	-		-	-	15	15	20	20
HAWAII	20	15	20	40	40	40	-	20	20	15	15	10
INDIA	-	15	20	-	-	-	-	-	20	-	-	-
JAPAN	10	15	20	-	-	-	40	40	40	-	-	20
MEXICO	15	20	20	-	-	-	-	20	15	10	10	10
PHILIPPINES	10	15/20	15/20	-	-	40	40	40	-	20	-	20
PUERTO RICO	15	20	20	-	-	-	40	40	40	-		20
SOUTH AFRICA	20	20	-	-	-	-	-		15	10	15	15
U.S.S.R	-	-	-	-	-	-	-	-	20	20	-	-
EAST COAST	15/20	20/40	80	160	160	160	-	-	-	10	10	15

*Try 80 meters.

The bands shown represent the highest usable a these times on "Good Days."

Note that the lower frequency bands open first and close last.

DECEMBER

		1 G-F	2 F-P	3 P	4 P	5 P-F
6 F-G	7 G	8 G	9 G	10 G	11 G-F	12 F
13 F-P	14 F-P	15 F-P	16 F-G	17 F	18 F	19 F-G
10 G	21 G	22 G-F	23 F	24 F-G	25 G	26 G
27 G-F	28 F	29 F-G	30 G	31 G		